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Trade Fight in Cincinnati

The unfortunate contention existing between the Cincinnati electrical trade and the local central station (a review of which is presented on a following page) is a striking example of what happens when patience and forbearance are absent in the handling of trade-relation questions. For some years the retail dealers have had their way in the Queen City, and central-station development there has been slow and backward. Now the company, through its new management, has been forced to take a hand. But, despite the company's assurance that prices are to be maintained on appliances, the local dealers have been anything but quieted by the repeated announcements of cut-price sales—sometimes on obsolete apparatus—and sales which in some cases were extended beyond the period limit promised. It is a fact that in four short months the Cincinnati company has accomplished some phenomenal results in increasing its sale of appliances, the great bulk of which have been disposed of at prices fair alike to customers and to other dealers. Nor will the central station's right to control lamp wattage by fixing prices to its customers be gainsaid. But it is a matter for doubt whether the small gain in load secured by slashing prices on a few hundred fans, fixtures or appliances could ever be worth alienating the local trade's friendship and arousing the present attitude of obstruction, especially at a time when constructive help is so needed from every possible side as is at present the case at Cincinnati. Two hands at the oar are better than one. It is high time for the Cincinnati factions to bury the hatchet and get together on a basis of mutual helpfulness.

A Suggestion for Fly-Time

In every banging screen door in the retail business section the electrical salesman should see possibilities for placing an electric fan that will run from ten to sixteen hours a day. For it is a fact that a ceiling fan located over an open doorway will keep out the flies as effectively as if the screen itself were there. Winged insects will not attempt to pass through the miniature tempest of the whirling blades' down draft. The screen door at best is noisy, ugly and an inconvenience. It interferes to a considerable extent with free ventilation, and from the brightly lighted street it shuts off the view of the darker store interior almost as much as would a solid door. The fan-guarded opening, on the other hand, presents an inviting appearance from the street, and the perspiring passer-by is encouraged to stop a moment in its refreshing artificial breeze, inspect the window display and possibly even enter and make the purchase thus suggested. Among other hot-weather hints here is a long-hour summer application worth developing.

Electricity and the "Sane Fourth"

We deem it the psychological moment again to refer to the movement for safe and sane methods of celebrating the birthday of our independence as a nation, and the fitting part therein to be played by the central-station industry and all forms of electrical illumination and display. Nearly a year ago we took occasion to comment upon the public spirit displayed in this connection by the New York Edison Company and other public-service companies, which took an active part in providing illuminative displays upon similar occasions. Each year the needless toll of human life and limb becomes less, thanks to an awakened public sentiment which favors the passing of the firecracker, the toy pistol and the cannon. In experienced and competent hands the use of such explosives and noise-manufacturing agents may be comparatively safe, but there is every reason for restricting their general use, particularly by the young and inexperienced. We need sacrifice none of the spirit which contributes to our greatest of national holidays, but in this as in other things the principles of true conservation should be applied. To the central station an opportunity is thus given to perform a public service in co-operating with municipal authorities to devise suitable public displays in keeping with the real significance of the "glorious Fourth," and at the same time to suppress in some degree that general ill-will and suspicion of public utilities of all kinds which is so easily aroused and so hard to dispel.

Automatic Substations

The A. I. E. E. paper by Mr. H. R. Summerhayes, abstracted on page 1422, describing an automatic substation recently installed in Detroit is an extremely suggestive one in its bearing on the future development of central-station work, perhaps more broadly suggestive even than its author has indicated. The time comes in the development of any large central-station business when the means of distribution is beyond the limit of useful application. The 220-volt direct-current network has expanded usually much beyond its economic radius, and the question arises whether it shall be extended by means of substations with rotary converters or given over to alternating-current distribution. Usually both horns of the dilemma have been faced. Substations with converters have been established where the load-factor seemed to warrant it and alternating-current distribution has been carried in the outlying districts. The practical result in numerous instances has been the growth of a system of substations progressively getting more intricate in their equipment and methods of operation. The costs of distribution due to substation operation have been steadily rising for at least the past decade. The substations themselves have grown more costly and more complicated

in apparatus, to say nothing of the steadily increasing labor cost. The installation described by Mr. Summerhayes represents a commendable attempt at simplification by means of a substation containing a 500-kw synchronous converter worked entirely by remote control. It is a comparatively modest equipment located about a mile from the main station in a heavily loaded residence district. The only connection between the two stations is a 4400-volt, three-phase cable carrying the main current. The whole work of handling the substation is done through this transmission-line control, in which there is an induction regulator with ample margin for furnishing the proper voltage at the converter terminals. The equipment has been in use long enough to show that it is actually simple to operate and that it does not require any special attention except daily inspection. The great difficulty is the possibility of failure and shut-down from causes which would not necessarily be operative in case an attendant were on hand. It would take a long period of active service to show how much of continuity is sacrificed by complete reliance on automatic apparatus. One cannot help wondering whether dependence on the single power cable is desirable and whether the actual operation of the station, including regulation, could not have been carried out more simply in the long run by the use of a pilot cable. Still further the question arises whether it is worth while to use direct-current apparatus at all in substation extension unless in some special case like the one before us where an existing direct-current installation carrying a fairly heavy load had outgrown its supply. A substation with only stationary transformers can be made extraordinarily simple, and perhaps most engineers would think it on the whole more reliable than one containing synchronous converters with the necessary means for protecting them, but certainly the Detroit automatic substation is a noteworthy example of extreme ingenuity in suiting the means to the end.

The Goldschmidt Alternator and Radio-Transmission

In the June number of the *Philosophical Magazine* Dr. Oliver Lodge discusses two subjects of interest to radio-engineers but of very different character—namely, the theory of the high-frequency Goldschmidt alternator and that of the transmission of electromagnetic waves over the surface of the globe. The Goldschmidt alternator is a machine which, running at a fairly high speed, with resonant circuits comprising condensers and choking coils connected to both the stator and the rotor, builds up a final high frequency in a part of one of these resonant circuits, which is a harmonic of the rotation frequency. The fundamental differential equations of the system are shown to be very simple, but no direct solution for these has yet been discovered. A step-by-step solution is, however, offered under several forms.

In regard to the emission of waves from a simple vertical rod oscillator, it is shown that at a distance near the ground of about one-ninth of a half-wave length, or just about the region at which true waves are thrown off, the magnetic intensity is about 40 per cent greater than the electric intensity, whereas in any single true wave these intensities must be equal. Consequently, any dissymmetrical means of intensifying the electric intensity at this distance will tend to throw off radiation waves stronger than along less favored directions. A rocky precipice is suggested as a possible cheap substitute for a ball antenna system, the energy losses in the rocky support being possibly no greater than in the metallic members of a large set of supporting towers.

An interesting action of the electromagnetic waves on free electrons is pointed out, whereby they are pushed along the lines of radiation or swept rectilinearly into the sky. The energy of the translatory motion is, of course, taken from the radiation, but, at constant velocity, there would cease to be loss. According to this theory, there might be lessened condensation of water vapor into cloud in the neighborhood of a powerful radio-active generating station as compared with more remote localities, by reason of the denudation of the elections, on which such vapor must nucleate if it condenses. The suggestion is also offered that a very feeble amount of ionization density in free space would be accompanied by an absorption of light-energy traversing such space, so that there might be a very small yet appreciable degree of opacity in free interstellar space, due to minute scattered ionization.

Positive Rays and Chemical Research

Note is made in the *Digest* in this issue of a recent Royal Institution lecture by Sir J. J. Thomson on the use of positive rays in chemical investigations. Rarefied air in a glass chamber is subjected to an electric discharge. The cathode has a small hole in it, so that positively electrified material particles are projected, in a straight stream, down this hole. They are then allowed to emerge under a conjoined electric and magnetic field, which causes all particles of the same mass to spread over the surface of a right conical emergent stream, even though their velocities differ. All the hydrogen emerging molecules will therefore stream out on one conical surface, all the neon molecules on another, and so on, the various cones being nested coaxially. A photographic plate supported so as to receive the impacts of the molecules becomes chemically altered at the points struck, so that the successive cones leave parabolic lines on the finally developed plate. Each parabola is capable of being identified with some one and only one atomic weight. A particular parabola of atomic weight 3, not corresponding to any yet known substance, has a large share in this interesting discourse, which may be popularly described as a detective story for X_3.

Recent experiments with the positive ray analysis have developed some very curious things. For instance, in analyzing a mixture of the lighter gases obtained from the residues of liquid air there appear not only the lines of helium, neon and argon, each in its appropriate place, but also a new line of particles of which the deflection corresponds to a gas of atomic weight 22, a weight which does not fit any of the known gaseous elements. There is a bare possibility that it may be a new compound instead of a new element, and further investigation will be needed to determine the point. Still more curious is the persistent

appearance under certain circumstances, and very various ones, of lines calling for an element or compound of atomic weight 3, of which there is no other indication save a prediction by Mendeléef which does not seem very well to fit the circumstances of the case. Even more remarkable is the evidence found by this method of investigation of the occlusion by metals of gases so firmly held that they can be driven out only by bombarding the substance with cathode rays. It turns out that it is almost impossible to rid metals of such simple gases as hydrogen, CO_2 or CO. Even after repeated heating has apparently eliminated all the gases from the mass, exposure to cathode rays will start a fresh outburst. It was this phenomenon, apparently, which was the origin of the latest suggestion of the transmutation of elements, commented on recently in these columns.

Sir J. J. Thomson thinks that there may be a quasi-chemical union between the gases and metals, perhaps similar to the holding of water of crystallization in salts. Certain it is that this method of positive ray analysis possesses a beautiful delicacy that is incomparably better suited to the minute analysis of gaseous mixtures than any other method known to science. It seems to get a direct and informing hold on quantities of matter so minute as to be quite beyond the possibility of detection by any other means. In particular it gives direct information as to the atomic or molecular weight of the gas concerned, and it apparently is to be, in the skilled hands of its discoverer, of great importance to physical science.

Energy Transmission at Constant Current

We have repeatedly expressed the opinion that the long-distance transmission of energy at constant current is by no means out of the running. It is not popular in this country, it is not a method of universal applicability, it is not even suited to the ordinary case of energy transmission, yet it has some features of merit which cannot be overlooked. In one of the papers read before the joint meeting of French and British electrical engineers at Paris and abstracted in this issue, Mr. J. S. Highfield considers at some length the status of constant-current transmission and gives an interesting analysis of some of the costs which bear directly on the applicability of the system. At least a score of plants on this system are now in successful operation, the oldest of them having been in service for more than twenty years. That they have not been replaced is sufficient evidence that they possess practical operative qualities which have proved advantageous. The most important of the list is the Moutier-Lyons plant, which is a straight-away transmission of 112 miles worked originally at nearly 60,000 volts at full load. The two additional stations more recently installed bring the total line pressure up to 75,000 kw and the total output to nearly 15,000 kw.

The strong point of the system is the ease with which it is adapted to transmission by underground cables. A continuous current, free from all difficulties connected with inductance or static capacity, is clear from resonance and produces very much less strain on the insulation than is the case with an alternating current of similar voltage. The cable in the Moutier-Lyons plant has been in use for the last seven years at nearly 60,000 volts and recently at 75,000 with good results. There is little doubt that this voltage with suitable cable construction can be doubled as an actual working pressure. It is the opinion of most engineers who have had experience with the constant-current system that cases of extremely long distance transmissions where continuity of supply is of the utmost importance can be dealt with more easily in this way than by the more familiar alternating-current system. Moreover, whether the line be overhead or underground, the lessened strain on the insulation with direct current cheapens the line, in the latter case very much.

Mr. Highfield presents estimates of cost on a 100-mile line of duplicate circuits transmitting 30,000 kw at 60,000 volts, and finds for the three-phase transmission a line cost of 47.5 cents per kw-mile as against 40.5 cents by constant current. When it comes to underground construction it is a question whether anybody would venture to use a three-phase cable at anything like the voltage here considered, and Mr. Highfield finds that, taking the highest practicable voltage for underground work in either case, based on present experience, the cost of the lines for the alternating-current system would be more than double that by the constant direct-current system. In addition, the latter has the advantage that it can be worked with the utmost readiness as a grounded circuit so that a complete metallic circuit once established can in case of a fault not involving both wires be operated as a grounded system and carry the load until repairs can be made.

With respect to station costs a constant-current system suffers under the disadvantage, in some cases, of relatively small size of units. At the present time it is practicable to build generators of from 100 amp to 200 amp with 5000 volts across the terminals, a limit which can probably be somewhat exceeded. A single-unit generator therefore can be pushed up to 1000 kw, or somewhat more. It is the custom to connect the units in mechanical as well as electrical series to single-prime movers, and in the Moutier-Lyons plant the largest combined unit thus constituted is a 4000-hp turbine coupled to two double generators giving somewhat more than 2700 kw. For the very large work at long distances the constant-current system is at a material disadvantage in regard to the cost of the generators themselves. This, however, is somewhat compensated by the rudimentary simplicity of the switch gear as compared with the enormous and forbidding complications which have grown up around most alternating-current transmission systems. In the long run Mr. Highfield believes that the actual station costs will not be very different for the two systems in heavy hydroelectric work, the advantage tending, however, to lie with the alternating machines. As regards substations the same situation holds good. Where frequency changing is undertaken, as is likely to be the case in extremely long transmission systems, the two systems stand about at a parity. A few years of experience on the Moutier-Lyons system in its present state will doubtless give very valuable information in the matters of cost and reliability, but meanwhile it is sufficiently evident from the facts here presented that constant-current transmission remains a live issue.

The News of the Week

Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Germans Honor Westinghouse

At the annual meeting of the Verein Deutsche Ingenieure, held at Leipzig, Germany, June 23, and attended by the visiting members of the American Society of Mechanical Engineers, the Grashoff gold medal was awarded to Mr. George Westinghouse. The medal was established by the Verein in 1894 in honor of one of its founders, Frank Grashoff, who died in 1893. Each year the memorial is presented to an engineer who has rendered distinguished service to technology. Mr. Westinghouse is the first American to receive the medal. Others to whom it has been awarded are Sir Charles A. Parsons, England; Mr. Gustav de Laval, Sweden; Count Ferdinand von Zeppelin, Germany, and Mr. Aurel Stodola. The award to Mr. Westinghouse is especially appropriate at this time when a party of 300 members of the American Society of Mechanical Engineers, of which he is past-president, are touring Germany as the guests of the German engineers.

Among the other honors granted Mr. Westinghouse have been the award of the Edison Medal, 1911, by the American Institute of Electrical Engineers; the John Fritz Medal, 1906, by the four American engineering societies, and decorations conferred by the French Republic and the Kings of Italy and Belgium. He has also received the degrees of doctor of engineering from the Königliche Technische Hochschule of Berlin and Ph.D. from Union College, Schenectady, N. Y. Mr. Westinghouse is an honorary member of the National Electric Light Association and the American Association for the Advancement of Science.

Electric-Heating Rate Below Cost Authorized by Massachusetts Commission

The Massachusetts Gas and Electric Light Commission has issued a decision approving the application of the municipal light board of the town of Marblehead for the right to establish a price of 5 cents per kw-hr. for electricity for heating. The computation submitted by the municipal board of the cost, as defined by the statute, was 6.56 cents per kw-hr. The commission states that without fully accepting the accuracy of this computation an examination of the plant's affairs makes it evident that the proposed price is less than cost, as defined by the Revised Laws, Section 22, Chapter 34. The board has had occasion to discuss the more important questions involved in this application in the similar Westfield case, summarized in the *Electrical World* for June 14, page 1303. Without repeating that discussion, the board points out that in deciding the petition it is not called upon to prescribe what rates shall be established nor specifically to approve that presented by the town, but rather to determine whether or not the rate proposed, with the limitations under which it is offered, is likely to be so prejudicial to the interests of the taxpayers or consumers generally that the board should interfere. Regarding this the commission says:

"The heating rate in question is urged by the municipal light board after experience with a schedule of higher prices has demonstrated that they were not sufficiently advantageous to secure the business. The price at which electricity can be used for heating is not necessarily or under all conditions governed by the cost of supplying it, but depends rather upon its value to the customer. It may, moreover, under some conditions, be furnished for this purpose at less than what appears to be the average cost without actual loss to the town engaged in the supply. The propriety of trying to obtain this class of business must therefore largely involve at the outset questions of commercial expediency. If the endeavor results in materially increasing output without proportionately increasing costs, there will be some commercial justification for undertaking the experiment, and to a degree the interests of the taxpayers and customers generally may be promoted rather than injured."

Annual Meeting of British Association for Advancement of Science

The eighty-third annual meeting of the British Association for the Advancement of Science will be held at Birmingham commencing Wednesday, Sept. 10, under the presidency of Sir Oliver Lodge, F. R. S., whose researches in electrical and physical science have given him a foremost place amongst scientific men of the present day. The engineering section of this meeting will be under the presidency of Mr. G. A. F. Aspinall, general manager of the Lancashire & Yorkshire Railway, which was the first important railway in the United Kingdom to adopt electric traction for its suburban traffic.

Status of E. V. A. Publicity Campaign Fund

The publicity committee of the Electric Vehicle Association of America, through its chairman, Mr. Frank W. Smith, reports splendid progress in the work of soliciting funds to carry forward for another and second year the national co-operative publicity campaign to promote the use and adoption of the electric pleasure and commercial vehicle. The amount so far pledged approximates $35,000, and the committee is making a final plea so as to bring the amount to at least the sum expended for the first year. An especial appeal has been made to the central-station interests, in the form of a very attractive circular and return stamped post card to those central stations which have not already subscribed, asking that every company make a "booster" or "good-will" contribution.

Radio-Telegraph Patents Litigation

Judge Van Vechten Veeder, of the United States District Court for the Eastern District of New York, has for nearly two weeks been hearing rebuttal testimony in the cases brought by the Marconi Wireless Telegraph Company of America against the National Electric Signaling Company, owner of the Fessenden patents. Bills of complaint praying for damages and injunction against alleged infringement were filed by Messrs. Sheffield, Bentley & Betts, solicitors for the Marconi company, nearly a year ago. Answers were returned and prima facie and defense proofs taken before special examiners according to the old rules governing patent practice. The rebuttal testimony

was begun after the new rules of equity proceedings took effect, and therefore has been heard in open court.

There are two distinct suits comprising the present litigation, the first referring to Marconi's United States patent reissue No. 11,913 (original No. 586,193, filed Dec. 7, 1896, and issued July 13, 1897) and to No. 609,154 (filed Feb. 1, 1898, and issued Aug. 16, 1898) of Sir Oliver Lodge, while the second suit is based upon United States patent No. 763,772, issued to G. Marconi, June 28, 1904, on application dated Nov. 10, 1900. Prima-facie testimony in both cases was begun in August, 1912, by Mr. R. O. Wiegant, who stated that he had been employed by the defendant National company and who described in detail the arrangement of apparatus which constituted the alleged infringement. In October and November of the same year Mr. Frank L. Waterman, of New York, closed the complainant's proofs with his expert testimony. The first evidence in defense was taken by Mr. F. W. H. Clay, attorney for the National company, last February, when Prof. R. A. Fessenden took the stand. Professor Fessenden was followed by Dr. A. E. Kennelly and a number of other witnesses, including Messrs. F. L. O. Wadsworth, Henry W. Fisher, S. M. Kintner, D. S. Wolcott, William Bradshaw and J. L. Hogan, Jr., whose testimony was not completed until April last. The rebuttal case of the first suit was opened before Judge Veeder on June 16 with testimony of Dr. G. Marconi, who held the stand for three days. Mr. Waterman then took the witness chair and submitted to examination by Mr. L. F. H. Betts, for the complainant, and Messrs. F. W. Winters and F. W. H. Clay, for defendant, until Monday evening last, at which time Mr. John W. Griggs, president of the Marconi company, gave a short deposition. At the present writing, Tuesday, June 24, opening arguments in the second case (Marconi's patent No. 763,772) are proceeding. It is expected that the latter suit will be concluded promptly, since much of the testimony is similar to that given in the first suit and may be read direct therefrom.

The only claim of No. 11,913 in issue is as follows:

"3. The combination, in an apparatus for communicating electrical signals, of a spark producer at the transmitting station, an earth connection to one end of the spark producer, an insulated conductor connected to the other end, an imperfect electrical contact at the receiving station, an earth connection to one end of the contact, an insulated conductor connected to the other end and a circuit through the contact, substantially as and for the purpose described."

According to Dr. Marconi and Mr. Waterman, on rebuttal, to this claim the broadest possible interpretation is to be given and it should be held to cover any system of radiotelegraphy utilizing grounded waves. The "imperfect contact" element is considered the keystone of the combination, since the complainant claims it to include all oscillation detectors, even those of the "good contact" crystal or electrolytic types. The National company urges that the patent should be read in the light of wireless knowledge at the time of its application date and that Dr. Marconi's claims should be limited to the original intentions of the inventor as shown by his early lectures and publications. The complainant goes so far as to classify the hysteresis-type magnetic detector as within claim 3 above, stating that while it may not be an "imperfect contact" device, it acts like one and is therefore an equivalent. The defendant company is attempting to show that the crystal and electrolytic detectors are outside of the claim quoted, since if read in the light of the specification the "imperfect contact" is a resistance-varying device which controls power from a local battery and makes signals thereby. It is claimed by the National company that when the crystal or electrolytic detectors are used all response given is produced by power received on the antenna, the local battery being used only to increase the sensibility of the detector, and the work of Dr. G. W. Pierce as well as of the company's experts is pointed out in confirmation of this view. Dr. Marconi also states that in addition to his invention of the combination including an imperfect contact he is also entitled to a monopoly covering the use of grounded waves for wireless telegraphing. Early work by Popoff, Lodge, Tesla and others has been quoted by defendant to offset this claim, and it is stated that the patent shows Marconi himself did not appreciate the true action or advantages of grounded gliding half-waves until long after his specification was filed. Numerous other points are in issue, and determination of the rights of the Marconi company under this patent will constitute settlement of what is probably the most important litigation which has occurred on the subject.

The Marconi reissue patent was sustained as to claims 3 and 5 against the De Forest Wireless Telegraph Company in 1905 by Judge Townsend (No. 138 F. R., pages 657-681). In that instance infringement was determined mainly by defendant's use of the De Forest-Smythe "goo" detector, which was held to be a true anticoherer resistance-changing device. The bearing of the earlier decision upon the present case does not seem very direct, except in that Judge Townsend appeared to feel that he was extending a liberal range of equivalents to Marconi by placing the "goo" detector within the coherer class.

The Lodge patent, No. 609,154, has in issue claims 1, 2 and 5, of which the first is representative:

"1. In a system of Hertzian-wave telegraphy, the combination with a pair of capacity areas of a self-inductance coil inserted between them electrically for the purpose of prolonging any electrical oscillations excited in the system and constituting such a system a radiator of a definite frequency or pitch."

This patent has never been litigated, but is stated by the Marconi company to cover all plans for wireless telegraphy, grounded or ungrounded, wherein the radiating circuit includes an inductance in coil form. The defendant quotes a large number of references to work antedating the Lodge patent, and claims that the patent lacks novelty capable of such broad application.

The second suit, No. 31, upon Marconi's patent, No. 763,772, in which the rebuttal testimony is not completed, alleges infringement of fifteen claims of the patent, including the following:

"8. At a transmitting station employed in a wireless-telegraph system the combination of a transformer whose secondary is connected to an open circuit including a radiating conductor at one end and capacity at the other end, a variable inductance being included in said circuit, and whose primary is connected to a condenser circuit discharging through a means which automatically causes oscillations of the desired frequency, substantially as described.

"10. A system of wireless telegraphy, in which the transmitting station and the receiving station each contain an oscillation transformer, one circuit of which is an open circuit and the other a closed circuit, the two circuits at each station being in electrical resonance with each other and in electrical resonance with the circuits at the other station, substantially as described.

"19. In a system of wireless telegraphy, the combination at a receiving station of an oscillation transformer; an open circuit comprising, in part, an aerial conductor connected with one end of the primary coil of the oscillation transformer; a connection from the other end of said coil to capacity; a variable inductance in said open circuit, and electrical connections from the secondary coil of the oscillation transformer to a receiving instrument, battery, condenser, wave-responsive device and a variable inductance, substantially as and for the purpose described."

This is the United States patent of Marconi on "four-circuit tuning," and it corresponds to the British 7777 patent of 1900, which was sustained by Mr. Justice Parker

against the British Radiotelegraph & Telephone Company in 1911. It is stated to cover the use, in a wireless system, of tuned closed and open circuits, in combination, at sender and receiver. The defense of the National company is said to be based upon anticipations of the patent in the work and publications of Tesla, Fessenden and others.

Inasmuch as a decision interpreting the claims of these patents as broadly as is urged by the Marconi company would result, unless reversed by the District Court of Appeals, in a complete monopoly of wireless telegraphy in the United States, the litigation is being followed with much interest by all who are connected with radio work.

A. I. E. E. Annual Convention

On June 23 amid the picturesque surroundings on the southern shore of Otsego Lake, at Cooperstown, N. Y., members of the American Institute of Electrical Engineers gathered for their thirtieth annual convention, with headquarters at the Otesaga. Approaching their destination from various directions, by rail, interurban cars and motor, about 125 members and guests reached their objective point in due season for the formal opening of the convention with a reception and dance on Monday evening. No little interest was added to the week's events by the circumstance that the meeting place lies in the heart of a region made famous by J. Fenimore Cooper in his "Leatherstocking Tales," thus abounding in historic associations as well as possessing the natural charm of lake and wooded mountain. Through the careful arrangements of the committee in charge those attending the convention found their comfort well provided for and an inviting program of both professional and social interest awaiting them.

Opening Reception

The convention exercises were formally launched by a reception and dance at the Otesaga on Monday evening, June 23. This pleasant event was held in the main ballroom, which lent charm to the occasion by its simple and harmonious decoration in the old colonial style. Standing in the receiving line were President R. D. Mershon, Past-president D. C. Jackson, President-elect C. O. Mailloux and Secretary F. L. Hutchinson. After all had been presented, although formal introductions were hardly the necessary order of the evening, dance music was provided by an excellent orchestra and the festivities continued until the early hours. What the event possibly lacked in numbers, as compared with similar occasions in former years, it more than made up in enthusiasm and enjoyment. The announcement that informal dancing each evening would be one of the features of the convention proved to be popular news and attested that the social side of the Institute's yearly gatherings is growing more and more attractive.

Opening Session

On Tuesday, June 24, the first formal session was called to order at 10:30 a. m., with President Mershon in the chair and both members and their guests in attendance. First on the program was the president's address, an abstract of which appears below.

Address of President Mershon

Mr. Ralph D. Mershon in introducing his subject stated that it had been quite generally the custom for the retiring president to discuss some topic concerning engineering in general, and the exception, rather than the rule, to deal with Institute affairs. The latter topic was selected as the subject of his discourse in view of the eminent fitness of such a proceeding on the part of one who has long been connected with Institute affairs and has had its best interests always at heart.

He stated that while it is quite generally the wish of all concerned that the Institute's activities shall increase, for example in the appointment of new technical committees, new sections formed, and additional section meetings held to discuss important topics, there is necessarily a limit to such increased activity imposed by the burden of its cost. This raises the general question of the relationship between income and expenditure. The cost of publishing and distributing the Institute *Proceedings* and *Transactions* is fast approaching the maximum permissible limit, and it becomes almost imperative to consider what measures of relief should be adopted in the near future. There seem to be, he said, three possible solutions. Either the present rate of increase in Institute activities must be reduced, the expenses must be cut in some manner, or the income must be increased. There being obvious objections to raising the dues or reducing the Institute activities, the most desirable course is that of reducing the expenses.

Printing is the largest single item of expense, and probably is much larger than is really justified. Probably the Institute occasionally prints papers which could more properly appear in the technical press. Moreover, all Institute publications are now sent to all members, whereas the interest of the individual members in them is limited to special topics, and the same matter is now sent twice to each member. Mr. Mershon appealed to the membership to consider this problem and assist in its solution.

Speaking of the effect of the formation of new engineering societies and their recruiting of membership, from the standpoint of the Institute's welfare and the effect upon its finances, Mr. Mershon said he could see no objection to such societies; on the contrary, he saw results of a possibly beneficial nature. And for similar reasons he saw no advantage in amalgamating the membership of engineering societies in one great organization, save by general representation—not individual membership—in a holding society of an all-embracing nature.

In discussing the scope of the Institute's activities, Mr. Mershon took occasion to emphasize the changing character of the times and the need for engineers to recognize the rapidly growing importance of the economic phase of their work and its related problems. There has long been a tacit tradition, he said, to limit Institute affairs to purely technical matters, but this in reality is a narrow viewpoint since the successful or useful engineer must be also an economist. This is evidenced by the increased consideration given to such questions as valuation, depreciation, operating costs, etc. He made a strong plea for the broadened viewpoint and an expansion of Institute activities along these lines.

Expressing his belief in the correctness of the Institute policy regarding local sections, the president made a plea for an extension of their activities and the inauguration of section technical committees, and particularly the institution of section membership committees to make an appeal for new members by direct and personal solicitation. Circularizing for new members he regarded as undignified, and certainly much less effective than direct personal appeal by local committees.

It is also desirable, said Mr. Mershon, for the membership generally to take a greater interest in Institute affairs and aid in solving its problems. This would be facilitated by a better geographical representation of membership on the board of directors, and could be effected by increasing the board membership by representatives—vice-presidents and managers—from the more remote sections of the country. He also urged a policy of greater frankness and publicity regarding the proceedings in meetings of the board of directors, so as to enlighten the membership to a greater degree in relation to Institute problems and stimulate interest in and discussion of them. Discussion or contention, if it be in a fair spirit, is not only desirable but is also a sign of a vigorous and active organization.

Tradition and precedent, while important and never to be neglected, remarked the president, should be overruled if contrary to any course that on careful consideration

appears advantageous and desirable. Criteria of yesterday will not necessarily serve for to-day, nor those of to-day serve for to-morrow. An example of this is the modern discussion of eugenics, to which the president made an indirect reference. Continuing, he said that a spirit of open competition for Institute offices is one to be welcomed rather than otherwise; these honors imply both hard work and reward for previous effort in the Institute's interests. Circularizing in the interests of a candidate, in his opinion, is desirable. In conclusion Mr. Mershon said he recognized that in certain respects his remarks might be regarded as unorthodox, but expressed his belief that a large majority of the membership concurred in them.

At the close of President Mershon's address there was prolonged applause, evidencing appreciation of his great sincerity in seeking the Institute's welfare and recognition of the points which he brought out.

Next on the program was the introduction of President-elect C. O. Mailloux, who was a charter member of the Institute at its formation in 1884 and in addition to long service in its councils has represented it abroad on several occasions.

ADDRESS OF PRESIDENT-ELECT MAILLOUX

In responding, Mr. Mailloux said that he felt more capable of delivering a sermon on the future of the Institute and its opportunities than making a speech. Speaking of criteria, as dwelt upon by President Mershon, he said it should be recognized that there are some criteria which are fundamental or permanent and others which serve but for the time being, comparing them half-humorously to fundamentals and harmonics of complex waves.

He then spoke of the desirability of a broader view of the engineering profession and the relation of engineers generally to affairs of public importance. We have passed, said he, from a primitive state to a higher plane and our outlook should be adjusted in keeping with the new developments. Especially should there be a movement toward better ideals and higher professional ethics. Engineers must be recognized as a factor of force in real life, with influence, weight and authority in public affairs. There are many reasons why the engineer should play an active part in every-day affairs. In order to bring these things about it is necessary to develop a higher sense of co-operation and unity of purpose in engineering as a whole, meetting the other national societies in a mutual effort to reach this goal. World problems awaiting solution need most profoundly, said Mr. Mailloux, the help of engineers. As a whole the profession needs greater homogeneity than it now enjoys—a welding of the present heterogeneous elements into a harmonious unit working toward a common end.

The president-elect said that, although there were some things with which personally he could not agree in Mr. Mershon's address, as a whole he approved of the views expressed, and remarked that the failure to agree upon every point is quite natural and proper, as the president himself pointed out. In closing, he said the Institute should above all be the means of developing a higher spirit in its members and inspiring a higher respect for knowledge among laymen the world over.

ENGINEERING SESSIONS

Following the presentation of the addresses of the president and president-elect, Dr. William McClellan read his paper entitled "A Suggestion for the Engineering Profession," dealing with the formation of an association of engineering societies. His main suggestion was enthusiastically indorsed by Messrs. C. O. Mailloux, Oberlin Smith, C. L. Clark, D. B. Rushmore, C. L. De Muralt and D. C. Jackson.

In the absence of Chairman S. G. McMeen, of the telegraphy and telephony committee, Mr. F. F. Fowle of the committee acted as chairman for the session held under the auspices of this committee. The remaining sessions of the convention were under the auspices of the following Institute committees: electrochemical, educational, high-tension transmission, industrial power, power station, electric lighting, and electrophysics. Abstracts of the papers presented at the convention and the discussions thereon will appear in a later issue.

Strained Trade Relations at Cincinnati

Bitter charges of price cutting and unfair sales practices have been made against the Union Gas & Electric Company, of Cincinnati, Ohio, during the past few weeks by some of the local electrical dealers and contractors. Meetings of protest have been held at which the company's business policies were vigorously assailed, and however justifiable the position of either the central station or the dealers may be, it cannot be denied that a spirit of antagonism and obstruction now exists in the local electrical field.

The dealers charge that the electric company has sold fans below cost, cut prices on appliances, sold fixtures at one-third cost, cut lamps 25 per cent below list prices, proffered wiring jobs at a 3 per cent margin of profit for the contractor, and is now arranging to open a competing downtown appliance store at which bargain-day sales of electric devices will be a feature.

In rebuttal the Union Gas & Electric Company declares that the instances of price reduction on appliances and fixtures were only short-time sales of obsolete stock, beyond which, it asserts, there has been no price cutting. And while insisting on its right to fix the price of lamps to its customers as it sees fit, the company points out that the present "slash" in tungsten units has simply anticipated by a few weeks the general cut due July 1. The company also gives assurance that the new "Electric Shop" will be operated on a merchandising, profit-producing basis at maintained prices, but with occasional bargain sales to attract buyers, a policy regarded as thoroughly sound in department-store operation. Moreover, the central-station officials charge that the dealers have themselves been guilty of most serious price-cutting practices and declare that the present activity on the part of the electric company has been forced by the indifference, dalliance and inefficiency of the retail trade, in whose hands the local business has altogether rested during the last few years with discouraging results.

A CITY OF 400,000 WITH 17,000 CENTRAL-STATION CUSTOMERS

From a central-station standpoint Cincinnati is probably the least developed of any of America's large cities. With a population of 400,000, the present company, which controls the whole service, has only 17,000 electrical customers, of which number only 9000 are residence users. In comparison it is of interest that the local telephone company has 70,000 subscribers, although its minimum rate is $30 per year. On the other hand, isolated electric plants abound in the Queen City. A recent expert estimate placed their number at 990, although this figure is declared to fall far short of the truth.

The annual central-station output has ranged in the vicinity of 50,000,000 kw-hr. But while the number of the company's customers would do scant credit to a city of 125,000 population, the majority of its consumers are the larger users, so that the company thus obtains the satisfactory average incomes of about $60 per year from its lighting customers and $200 per year from motor users. The electric department has also the stiff competition of 30-cent natural gas sold by its own company.

One commercial campaign has been followed by another in the effort to improve electrical conditions at Cincinnati, but usually in the end the town has been declared "queer"

and unresponsive to modern commercial methods and the attempts have been abandoned. During recent years the appliance and lamp business has been left almost entirely in the hands of the local dealers. For years public opinion in Cincinnati has not been altogether friendly toward the public-utility corporation, a condition which adds to the unfortunate aspects of the present electrical situation.

Company's Bargain Sale of 12-in. Fans

When, following the advent of a new commercial staff, a Union company advertisement recently appeared in the Cincinnati newspapers offering 12-in. fans (either alternating-current or direct-current) for $9.98, complete with cord and plug, several local dealers declared this price to be less than they could buy such fans for in lots of 500. At a meeting of protest attended by some seventy-five persons interested the company's commercial manager took care to explain that this fan offer covered a limited consignment of 500 fans of last year's manufacture and of an obsolete finish, which had been purchased at a corresponding discount that permitted a small profit at the price quoted. One local retailer thereupon offered to buy outright the entire consignment at the advertised price, declaring that he had never been able to get such prices from even his jobber and that he could resell these fans at a good profit. The company agreed to the deal provided assurance was given that each fan should go to a customer using central-station service, but this the retailer refused to guarantee. The company also offered here, as on other occasions, to furnish to small dealers who might suffer from the effects of rate slashing by others appliances at the cost prices obtained through central-station purchases made in large lots. It was further explained that the cut-price sale at $9.98 was scheduled to last only two weeks, after which time the offer would be withdrawn. At the date set the offer had not, however, been withdrawn as promised, and the dealers again protested. Four days later the fan sale was actually brought to a close, the explanation given for having prolonged it beyond the original fortnight being that during ten of these scheduled fourteen days the street-car strike was in progress, arresting business generally and interfering with sales. In addition to the bargain fans the company also sold to persons attracted to its display room a number of the latest-type oscillator models, disposing of these at list prices as in the case of its other appliances.

"Rummage Sale" of Appliances

Advertisements for a "rummage sale" of show-room shop-worn devices at low prices by the central station later served to arouse anew the uneasiness of the dealers. This sale, it is explained, was held solely to clear out an old stock. But this rummage sale seems to have caused the dealers to forget that the company's appliance sales over its counter have, with this exception, been carried on strictly at maintained list prices. Indeed, in only four months these display-room sales, all at such maintained prices, have increased at the remarkable rate of 2600 per cent over the amount recorded during the first month of the present campaign. In fact, declares the company, it is itself that is most in need of protection against price cutting on the part of the dealers—for inquiry among electrical stores in Cincinnati revealed ranges in prices of 10 to 25 per cent on various articles with little attempt to maintain uniformity.

Another special offer made by the company which provoked criticism was an assembled crow-foot pendent fixture, complete with reflector and 250-watt lamp, which was sold for $2. The dealers declared the lamp alone should bring $2.50, while for the fixture complete they said they must charge at least $5.50. One dealer inquired the size of the stock of these fixtures which the company had on hand, and, as in the case of the fans, proposed buying the entire lot outright at the advertised price in order to resell them at a profit. In answer to the objections raised this time the company explained that this fixture sale again represented a limited-period clearing of old stock, including some out-of-date reflectors. At the expiration of the time limit the fixtures were restored to their present price, $4. The company promises that all its other fixtures sales will, as in the past, be conducted on a strictly merchandising basis with maintained prices.

Company Will Fix Own Lamp Prices

On the subject of tungsten-lamp prices to its customers the company, however, asserts its right to fix its own schedule. First announcement of the cut in prices in line with this intended policy came in March, although the cut then decided upon was not actually enforced until June, the delay having been due to the desire to co-operate with the dealers. As then finally fixed, the prices which went into effect for the Union company's customers were as shown in the table. Free renewals are granted for the larger sizes.

UNION GAS & ELECTRIC COMPANY'S LAMP PRICES

Lamp, Watts	List Price	Customer's Price
15–25	$0.40	$0.35
40	0.45	0.35
60	0.60	0.45
100	0.90	0.75

As finally enforced, these prices were applied the middle of June, only a few weeks before the general price cut (see *Electrical World*, April 26 and June 21) scheduled for July 1, after which date all the Cincinnati dealers will be privileged to meet the prices which the central station has been offering. Meanwhile the latter is of course getting the credit locally for having put down the price of tungsten lamps. The Cincinnati central-station company insists, however, on its right to sell lamps to customers at any price it sees fit in order to develop the business and to encourage use of the larger sizes.

House-Wiring Co-operation

From several sides has come the repeated statement that the company asked contractors to do house-wiring jobs on a basis of 3 per cent profit over labor and materials. No confirmation of such an offer or even any recollection of it could be obtained from the company's officials. The contractors have also protested against the unit schedule for estimating wiring prices on the basis of outlets, etc., declaring that unless a given contractor has a large number of such jobs accorded to him the law of averages assumed is not fulfilled and may work injustice in individual cases. Several local contractors have, however, since accepted the company's terms and are doing its work with apparent satisfaction at the prices obtained.

Avowing their wish to co-operate with the company even further, the contractors also declare that they offered to put extra solicitors on their own staffs to go after house-wiring contracts. The contractors' committee which submitted this proposal was, however, in no way authorized to sign an agreement as to the number of men who would be detailed to this work, and this plan also fell through. The company then went ahead marshaling its own organization for an aggressive campaign which is now under way.

Co-operative Advertising with Dealers

A plan for co-operative newspaper advertising in the form of an "electrical page" was another subject on which the two parties failed to agree. The dealers declare that after they had promoted such a page, the prospects for which seemed bright, the electric company refused to take part in it on the excuse of an insufficient advertising appropriation, although shortly thereafter the newspaper advertisement began to appear announcing the cut in tungsten-

lamp prices. The reason given by the company for failure to participate in the "electrical page" is that it doubted the wisdom of spending $75 weekly on a feature appearing only once a week in a single newspaper. In addition, the company would have been required to collect and edit the reading matter for the page. Instead of the single newspaper page once a week the company explained that it would prefer to hold off until some form of daily electrical advertising could be secured in all the papers, and expressed its willingness to co-operate at such time.

MAINTAINED PRICES AND BARGAIN SALES FOR ELECTRIC SHOP

At the "Electric Shop" which the Union Gas Electric Company is preparing to open on Race Street in the center of the downtown retail section prices of appliances are to be maintained, and the store, it is promised, will be conducted on a merchandising basis such as to pay its own way. List catalog prices will be generally observed, with the exception of bargain-day sales. On these days to attract customers, following the department-store practice, cut prices bordering on bare-cost values will be offered on certain appliances for a day at a time. The company justifies this policy on the basis of the best merchandising experience in the general field, pointing out that retail stores suffer little if any from the bargain sales conducted by department stores. It has offered to let local dealers share in these bargain-day sales if they desire.

Meanwhile, however, even a casual visitor may discover that co-operation is just now a rather remote quality in the Cincinnati field. The dealers and contractors, having themselves plunged into a campaign of price slashing, are suspicious and envious of one another, as they themselves will admit, and whatever community of spirit there is among them seems to find expression in antagonism to the central-station company. Some of the larger dealers are more temperate in their attitude, adopting the philosophic view that whatever the company may do to stimulate and develop the electrical business locally will ultimately redound to their own benefit. The rank and file of the electrical dealers and contractors in Cincinnati appear to recognize that the company holds the whip hand in the local situation. The only means of retaliation suggested, among all the protests filed by the dealers and contractors, relates to isolated-plant development, and this they declare they will encourage and recommend if the electric company continues to overlook their own rights in the local field. While the trade is thus embittered against the company, the latter seems to have about lost patience with any further attempts to conciliate the local field, and the spirit now in evidence is one of "fight" until the party least fitted to stand the siege shall surrender.

Illinois Public Utilities Commission Created

A bill passed by the Illinois Legislature last week and now awaiting the action of Governor Dunne creates a state public utilities commission of five members. The commissioners are to be appointed by the Governor, and not more than three shall be affiliated with the same political party. Eventually the term of office will be six years, the appointments being so timed that not more than two new members can be named in any year. The Governor shall designate the chairman. The commission shall appoint a secretary, an attorney, accountants, engineers and other employees. Each commissioner is to receive a salary of $10,000. The secretary's salary is $5,000 and the attorney's $6,000. The office of the commission will be in the capitol at Springfield and shall be open for business throughout the year.

DUTIES OF THE COMMISSION

The commission shall have general supervision of all public utilities. It shall examine franchises, capitalization, rates and other charges and also the service rendered. Rules and regulations to this end may be adopted. An annual report to the Governor shall be made in December, 1914, and thereafter.

Public utilities owned or operated by municipalities are specifically excluded from the control of the commission. All other public utilities are directed to furnish the commission all required information, to deliver required documents, accounts and records and to obey the orders of the commission. Public utilities are defined as individuals, firms, corporations and associations that own, control, operate or manage for public use "any plant, equipment or property used or to be used for or in connection with the transportation of persons or property or the transmission of telegraph or telephone messages between points within this State; or for the production, storage, transmission, sale, delivery or furnishing of heat, cold, light, power, electricity or water; or for the conveyance of oil or gas by pipe line; or for the storage or warehousing of goods; or for the conduct of the business of a wharfinger." Owners of franchises giving the right to engage in such business are also regarded as public utilities.

REPORTS AND ACCOUNTS

Power is given to the commission to establish a uniform system of accounts, to classify utilities for accounting purposes and to prescribe the manner in which accounts shall be kept. The system of accounts established shall not conflict with those of the Interstate Commerce Commission. Such accounts shall distinguish clearly between payments for operating expenses, and those for new construction. Utilities may be required to keep such accounts as will "adequately reflect depreciation, obsolescence and the progress of the arts." The commission may fix the rate of depreciation.

Annual reports to the commission shall be made by the utilities in the form required. Monthly reports of earnings and expenses must be given if asked by the commission; also special reports where demanded. All reports shall be under oath.

CONTROL OF STOCK AND BOND ISSUES

The power of public utilities to issue stocks, stock certificates, bonds, notes and other evidences of indebtedness shall be exercised by the commission. Securities sanctioned by the commission shall be identified as such. For certain specified purposes the utilities may issue securities after first securing permission from the commission. Such purposes, usually, shall not be such as are reasonably chargeable to operating expenses or income. The bill provides in detail for a rigid investigation by the commission when application is made to it for authority to issue stocks or bonds. If necessary, an adequate physical valuation may be made. The proceeds of the sale of securities must be applied as required in the commission's order. Notes running not longer than twelve months may be issued without the consent of the commission, but cannot be converted into stocks or bonds, or renewed for a longer period than two years, without consent. In case of merger the commission may not approve a capitalization exceeding the sum of the capital stock of the consolidated corporations at par plus any additional cash actually paid for improvements. Severe penalties are provided for the issuing of securities contrary to the provisions of the act. In the case of individuals a prison sentence of from two to ten years is imposed on conviction. The act is not to be construed as any validation or approval of past issues of securities.

MERGER OF UTILITY COMPANIES

Consent of the commission is necessary for the merger or joint operation of two or more utilities, or for the sale or lease of one to another. The same restriction applies to franchises. Where merger is contemplated each company

must file a petition setting forth all the circumstances, and the commission must decide, attaching such conditions as it deems necessary.

Must Be Illinois Corporations

After the law is in force, no franchise shall be granted to any public utility, except common carriers engaged in interstate commerce, other than a corporation incorporated under the laws of Illinois. No public utility shall be exempt from the provisions of the act by reason of the fact that it is incorporated under the laws of another state.

Valuation

The commission is to have power to ascertain the value of the property of every public utility in the State and every fact which in its judgment may have a bearing on such value. It shall have power to make revaluation from time to time.

Rates and Schedules

All rates shall be just and reasonable. Schedules showing all rates, charges and classifications must be filed with the commission and be open to public inspection. Without the consent of the commission these rates must not exceed those in effect on July 1, 1913. The commission has, however, power to fix rates in excess of those of the date mentioned or below them. Contracts between public utilities in relation to furnishing service or products must be filed with the commission. No utility shall increase any rate without a finding by the commission that such increase is justified. Provision is made for a hearing on the propriety of any rate, either on complaint or on the initiative of the commission. Neither more nor less than the schedule rate shall be charged, nor shall there be any refunds or rebates. Discrimination between customers is forbidden. Differences in rates as to localities or classes of service must be reasonable. Specific provision is made for the fixing of rates by the commission, after a hearing, where it is found that existing rates are unjust. No telephone or telegraph company shall charge more for sending a message for a shorter distance than for a longer distance over the same line.

Joint Use of Facilities

Every telephone and telegraph company must interchange with every other with which a joint rate has been established or with which a physical connection has been made. Physical connections between two or more public utilities may be ordered by the commission after a hearing. The conduits, subways, tracks, wires, poles, pipes or other property of one utility may be used by another if the commission finds such joint use of public convenience or necessity and also that it will not result in substantial detriment to the service of the first utility. This, however, does not apply to utilities mainly or primarily within a city.

Service and Equipment

The commission shall prescribe rules for the performance of any service by any public utility. Additions, repairs or improvements to plant and equipment may be ordered, if needed, after a hearing. The commission is authorized to regulate the conditions in contracts with customers. Also it may fix suitable standard commercial units of service, as, for instance, initial voltage. It may test meters and appliances and establish standards of accuracy. Any consumer may have any meter tested upon payment of the fees fixed by the commission. Commissioners and their agents may enter upon the premises of any public utility for the purpose of examination and test.

No utility shall begin the construction of any new plant which is not in substitution for any existing plant or an extension thereof without a certificate of public convenience and necessity from the commission. No new utility shall transact business without obtaining such a certificate. Rights given by such certificates must be exercised within two years.

Investigation of Accidents

Reports of all accidents must be filed with the commission. If the accident causes loss of life or limb, the utility must give notice of the fact immediately to the commission, using the speediest means of communication. The commission may investigate accidents, but neither the report from the utility nor the findings of the commission shall be admitted in evidence in any damage suit. Safety appliances may be ordered.

Manner of Procedure

All hearings shall be in public. Commissioners may issue subpoenas, compel the attendance of witnesses and administer oaths. No subpoenaed witness, testifying under oath, shall be subject to any penalty for anything he may divulge. Neglect to appear under subpoena is a misdemeanor. The commissioners and their duly accredited agents have the right, at any and all times, to inspect the papers, books, plant and equipment of any utility. When complaints are filed with the commission a copy shall be served on the utility. Utilities themselves can make complaints as well as citizens, societies, municipal corporations or others. Hearings may be had on complaints and rehearings if sufficient cause appears. On rehearing the commission may rescind or alter its decision. Appeal from the decision of the commission may be taken to the Circuit Court of Sangamon County. No new evidence may be introduced on appeal. From the Circuit Court the case may be appealed to the Supreme Court. The methods of enforcing the act are carefully set forth in several sections.

Old Railroad Commission Abolished

By the terms of the act the Illinois Railroad and Warehouse Commission, established in 1871, is abolished. The rights, powers and duties of this board are transferred to the State Public Utilities Commission of Illinois.

If the Governor does not veto the bill, the act will take effect and be in force on Jan. 1, 1914.

Tires for Electric Vehicles

Fifty-one additional electric-vehicle registrations were made in New England between June 1 and June 14, according to figures presented at a meeting of the Electric Motor Car Club of Boston on June 19. President Day Baker occupied the chair, and at the conclusion of the usual dinner a joint meeting was held at the Edison Building with the New England Section of the Electric Vehicle Association of America, Chairman Fred M. Kimball presiding. It was announced that in addition to the figures of electric-vehicle registrations printed in the *Electrical World* of June 14, page 1299, the following have been made: New Hampshire, three pleasure cars and one truck; Vermont, two pleasure cars and one commercial vehicle; Massachusetts, four passenger electric cars and three trucks; Rhode Island, two pleasure equipments and one truck; Connecticut, seven pleasure and eight commercial electric cars. The club membership is now 110, four new members having been added at the meeting, and there are seven more charging stations in New England than on June 1. Fliers are soon to be available for central-station mailing lists, these being prepared in red and black under the general direction of the club and advocating the electric vehicle for varied services.

Discussion of Electric-Vehicle Tires

Tires for electric-vehicle service were considered at length at the meeting, papers being presented by Messrs. Alexander Churchward, consulting engineer, New York; James E. Hale, Goodyear Tire & Rubber Company, Akron, Ohio; W. W. Duncan, Hood Rubber Company, Watertown, Mass., and T. H. McGiehan, Motz Tire & Rubber Company, Akron, Ohio. Mr. Churchward's paper pointed out

that the tire has more influence upon mileage than any other feature of vehicle equipment. Taking a Palmer single-tube tire as a standard, the energy consumptions of a number of standard modern tires in watt-hours per ton-mile on hard, level asphalt were as follows: No. 2, 115 per cent; No. 3, 132 per cent; No. 4, 133 per cent; No. 5, 143 per cent; No. 6, 158 per cent; No. 7, 163.5 per cent, all measurements being made by recording instruments under the author's direction. A standard pneumatic gasoline car tire required 169 per cent of the Palmer energy consumption, and the energy consumption of solid tires varied from 142 to 210 per cent of the above standard. Some special tires of the block type took only 140 per cent more energy than the Palmer standard, on account of the high quality of their material. A thirty-cell electric runabout with a fifteen-plate battery made 115 miles at 16 miles per hour with double-tubed Palmer tires. With another make of electric special tires it made 82 miles at 16 miles per hour; with ordinary pneumatics, 68 miles, and with a good grade of solid tire, 68 miles. The outlook is excellent for ultimate standardization of tires on the basis of tractive effort and ton-mileage relationships.

Mr. Hale's paper outlined the fundamental principles of tire development and emphasized the need of more scientific research in this field. It was pointed out that gasoline-car tires absorb more energy than tires for electric vehicles, the fabric being so rigid that considerable work is necessary in flexing the walls of the tire. Well-made electric vehicle tires are less rigid, the difference being easily seen by depressing them when deflated. From the manufacturer's viewpoint it is difficult to secure long tire life and a construction flexible enough to give low energy consumption. Under-tiring of cars has forced some excellent types of tires off the market. At present the most efficient tire made by the author's company is of soft base, reinforced with cross wires, attached to the wheel with side flanges. The other speakers urged the standardization of tire tests, criticised the existing guarantees of mileage now exacted by many tire purchasers, and advocated closer attention to fitting the proper sizes of tires to vehicles. Mr. Churchward brought out the point that the ordinary tractive effort required to overcome friction on a level roadway in using electric tires is about 24 lb. per ton. A brief discussion also occurred regarding the adequacy of dual 5-in. tires on 5-ton electric trucks, the point being made by Mr. Day Baker, of the General Vehicle Company, that over 1300 such trucks are in successful service. On hilly roads it was conceded that larger tires might be advisable, but for ordinary service Mr. Baker preferred to use the 5-in. tire even if it involved a slight sacrifice in life in operating on grades. The increased investment required in using larger tires is not always compensated for by the resulting life gains.

Convention of the Illinois Electrical Contractors' Association

On account of the labor trouble existing between the Building Construction Employers' Association and the Building Trades Council in Chicago, the semi-annual convention of the Electrical Contractors' Association of the State of Illinois, which was held in the Hotel La Salle, Chicago, June 20 and 21, was not so well attended as usual.

Mr. William McGuineas, president of the association, called upon Mr. Ernest H. Freeman, of Chicago, president of the National Electrical Contractors' Association, for a few words of welcome. The remainder of Friday morning was devoted to the discussion of various phases of the contracting business.

Relations of Contractor, Jobber and Public

The business relations of the contractor, jobber, manufacturer and public were the main topic of discussion. Several Chicago contractors said that this relation was not what it should be in Chicago. Among those who took part in the general discussion were Messrs. J. A. Hoevler, G. A. Harter and George Doolittle, of Chicago; J. Marron, of Rock Island, Ill.; H. M. Butler, of Peoria; A. S. Schulman; C. R. Creider, G. H. Lounsbery, J. E. Barron and E. H. Freeman, of Chicago; Guy Carlton, of Bloomington, Ill.; L. B. Van Nuys, of Peoria; R. W. Poelman and E. W. Donoho, of Chicago; C. E. Stapp, of Peoria, and Clark Methot, of Chicago.

Mr. Harter advised contractors to go into the fixture business because the two industries are closely allied. He also emphasized the fact that contractors having a wide acquaintance among architects would be able to establish considerable business in that line.

Mr. Marron said that the only way to keep the jobber from selling electrical supplies to the consumer at wholesale price was to promise him a certain amount of business. He expressed the opinion that a joint executive committee composed of contractors and jobbers could be instrumental in improving mutual operating relations.

Mr. Butler, of the Mills Electric Company, said that his company was endeavoring to sell only to electrical contractors, large consumers like central stations, and railroads, which would not solicit the services of the contractor anyway.

Mr. Creider said that if jobbers were trying to establish a uniform retail price for consumers they were not accomplishing it. He told of a contract which his company executed and in which it was required to quote a price on the material used which resulted in a loss rather than a profit. He also added that there are few industries in which there is such a tendency to retail to the consumer at wholesale prices as there is in the electrical business.

Mr. Lounsbery expressed himself as being in favor of maintaining different prices for the contractor and the consumer. If manufacturers and jobbers could get together on a mutual basis, he felt that the contractor could be placed in a better position. Mr. Lounsbery added that many jobbers in Chicago were purely brokers. The larger contractors do not depend on the jobber for supplies, but buy direct from the manufacturer; hence the jobber does not feel in a position to protect the contractor.

Mr. Barron, replying to Mr. Marron regarding co-operation of jobbers and contractors, said the Society for Electrical Development was established to bring this about.

Mr. Freeman said that he did not think the bottom had been touched in the discussion, and that the jobber should not extend credit to any but the legitimate contractor. The ease with which anybody can get into the contracting business and obtain credit, he said, is surprising.

Mr. Carlton deplored the tendency of manufacturing companies to require the small contractor to maintain a certain price on commodities and allow the larger concerns to sell at any price. He believed that the central-station companies should maintain the same prices as the jobber.

Partly in answer to these statements, Mr. Van Nuys said that the central-station company in Peoria maintains the same retail price as the jobbers and a local license keeps out the illegitimate contractors.

Mr. Poelman made the rather sweeping statement that the electric-service companies in Chicago are more of a stumbling block to contractors than all of the jobbers combined, because of the low retail prices which they place on energy-consuming devices and the repair work which the companies solicit.

In response to Mr. Carlton's statement, Mr. Donoho said that the Hotpoint Electric Heating Company attempts to maintain a uniform retail price by advertising the prices of its heating devices in popular magazines and in electrical periodicals. In addition, it tries to put the manufacturer, jobber, dealer and contractor on a mutual basis by its method of advertising.

Mr. Methot claimed that the Manhattan Electrical Supply Company tried to maintain separate prices for dealers and consumers. He told of the city ordinance which has been passed in Chicago requiring all buildings of a certain size to be equipped with electrical fire-alarm systems. The installation of these equipments was pointed out as a productive field for the electrical contractor, and he urged that contractors in other cities have a similar ordinance introduced in their respective city councils.

Friday afternoon and Saturday morning were devoted to executive sessions at which the various committees reported, delegates were elected to the national association, and officers for the state association were elected. The "state boosters" committee submitted a valuable suggestion to the effect that members from the different cities visit the meetings of the local sections in other cities and exchange ideas. The routine matters of the committee will be handled by Mr. W. L. Collins, of Chicago, who is at present secretary of the state and Chicago sections of the Electrical Contractors' Association and the Chicago section of the Faraday Electrical Association.

Election of Officers

The officers for the ensuing year are as follows: Mr. W. J. Ball, of Moline, Ill., president; Mr. J. T. Marron, of Rock Island, Ill., vice-president; Mr. M. Blumenthal, of Chicago, secretary; Mr. J. N. Pierce, of Chicago, treasurer. The last three men were re-elected to the positions which they held last term. Mr. Ball is also president of the Tri-City Electrical Employers' Association.

Three delegates were elected to the national association as follows: Mr. F. L. Decker, of Chicago, to succeed Mr. R. C. Bierdeman, and Messrs. C. E. Stapp and J. T. Marron, who were re-elected.

On Saturday evening a banquet and a dance were held in the Hotel La Salle. Mr. Marron acted as toastmaster in the absence of Mr. Ball, who was called home on account of illness in his family. "Shop talk" was prohibited under a penalty, and a pleasant evening was enjoyed by those present. Short talks were given by Messrs. Freeman, Creider, Collins, McGuineas, J. Cronin and A. Knauber, of Chicago.

The next meeting of the Illinois Electrical Contractors' Association will be held at Springfield, Ill., about the middle of January, 1914.

Convention of Brooklyn Company Section, N. E. L. A.

The fifth annual convention of the Brooklyn Company Section of the National Electric Light Association was held at the Oriental Hotel, Manhattan Beach, on June 25, 1913. The meeting was opened by an address by Chairman C. E. White, after which the official business of the section was transacted, including presentation of various reports.

A technical review of the salient points brought out in the reports of the N. E. L. A. committees on progress in lamp manufacture, street-lighting, meters, electrical apparatus, and underground construction, which were presented at the Chicago convention, was read by Mr. E. W. Babcock. The following took part in the discussion of this review: Messrs. W. Y. Vedder, William Eichert, J. H. Sinkinson, J. Laurencot, H. P. Pope, A. G. Paulsen, William Schaller, M. J. Shugrue, W. H. Grove, R. Stevenson, A. Hussey and F. E. Hanchet. The discussion was largely confined to local situations, but it was pointed out by Mr. Sinkinson that the committee on underground construction had overlooked in its report the fact that the temperature in the conduits and manholes varies enough to cause a creep in the cable of 4 in. on a 300-ft. run. Instances were cited where this had led to ruptures in the lead sheathing. It was recommended that a straight run of at least 4 in. be allowed at the entrance of each duct as assurance that the sheath of the cables would not be chafed by the creeping movement.

A paper prepared by Mr. F. H. Paterson and read by Mr. T. W. Flowers, entitled "The Relation of the Accounting Department to Other Departments of the Company," was discussed by Messrs. C. W. Hafstrom, T. S. Bates and William Trompen.

Mr. M. S. Seelman, Jr., quoted briefly from papers which had been presented at Chicago on the subjects of electrical merchandising, "Salesman's Handbook," wiring of existing buildings, refrigeration, and steam heating by central stations. These papers were discussed by Messrs. J. L. Wiltse, G. L. Leibman and C. H. Stevens. It was brought out in the discussion that there is a regrettable dearth of reliable data on steam heating, as applied to central-station service, and Mr. Stevens expressed his hope that in the next report of the committee such a compilation of data would be secured if possible.

At the close of the annual dinner given to the members of the Brooklyn Company Section by the Edison Electric Illuminating Company Chairman White announced that, although it was impossible for General George H. Harries, of the Louisville Lighting Company, who was to have been the guest of the section, to be present, Mr. W. F. Wells, vice-president of the Edison Electric Illuminating Company of Brooklyn, and Mr. W. W. Freeman, vice-president of the Alabama Power Company, would address the diners. Mr. Wells briefly discussed the increase in the company's business and stated that during the past year the output of electrical energy had been increased by 20 per cent and the net income by 6 per cent. He accounted for the seeming discrepancy by stating that the increase had been generally confined to large customers who paid low rates for energy. Mr. Wells also said that it is highly probable that the profit-sharing plan which the company now has in force will be retained, as there have been many instances in which it has been of true benefit to the employees.

Mr. W. W. Freeman recounted the marvelous natural resources of the State of Alabama and told of some of the hydroelectric projects which the Alabama Power Company has in course of development. He stated further that in that district, which the average New Yorker is prone to think upon as a wilderness, within the course of a short time there would be in operation plants aggregating 100,000 hp, delivering 250,000,000 kw-hr. of energy yearly, an output which is approximately twice that of the Brooklyn company's plants.

At the close of the evening session the names of the officers for the ensuing year were announced. They are as follows: Mr. C. E. White, chairman; Mr. W. H. Grove, vice-chairman; Mr. F. C. Hill, treasurer; Mr. J. G. Bogeart, secretary; executive committee: Mr. E. A. Leslie, chairman; Messrs. P. H. Bugg, W. J. Honan, R. J. Freese, T. Cusack, H. J. Tilden, J. G. McNelus, W. F. Schaller, J. P. Butt, S. B. Mentram and W. F. Wells, ex officio.

Massachusetts Public Service Commission Act

By the passage of the so-called Washburn railroad bill (Chapter 784, Acts of 1913) the Massachusetts Legislature has materially extended the powers of the Railroad Commission and reorganized it into a new body with enlarged membership requirements under the name of the Public Service Commission. The present Gas and Electric Light Commission's duties are in no way altered by the act, but the supervision of telephone, telegraph and any other organizations for the transmission of intelligence is transferred thereby from the Massachusetts Highway Commission to the new board. The latter has complete powers of regulation over common carriers of all kinds and possesses the power to initiate investigations regarding rates, service

and capitalization. It has substantially all the powers of the former Railroad Commission, with much greater scope of action and larger resources in the way of staff and advisory assistance. Liberal provision is made for the attendance of the board at state or federal hearings and proceedings outside Massachusetts, with ample powers relating to the conduct of its own work and offices, the examination of books and papers, compulsion of attendance of witnesses and papers, prescription of accounting forms, and valuation of properties.

A section of the act relaxes somewhat the conditions surrounding the issuance of bonds designed to retire other evidences of indebtedness. Free passes and service are prohibited except in specified cases. The board is to consist of a chairman, with an annual salary of $8,500, and four associated commissioners, at $8,000 each, an annual appointment being made by the Governor with the approval of the Council, for a term of five years.

The membership of the board, and the periods of service are: Messrs. Frederick J. McLeod, of Cambridge, five years; George W. Anderson, of Boston, four years; George P. Lawrence, of North Adams, three years; Clinton White, of Melrose, two years; George W. Bishop, of Newton, one year. Messrs. McLeod, White and Bishop were members of the Railroad Commission.

Lexington (Ky.) Franchise Annulled by Referendum

Opponents of the franchise recently granted to the Kentucky Utilities Company, of Lexington, Ky., have succeeded in having it annulled by a referendum vote, this feature having been incorporated in the new charter of the city, which is governed by a commission. It is the only Kentucky city so organized. Plans are now being considered for a new franchise, a referendum committee of citizens having arranged for the employment of an expert to assist in drawing up a franchise ordinance which will be submitted to the company. Mr. Percy M. Chandler, president of the company, has indicated that if a reasonable franchise is submitted the company will approve it.

Louisville Merger Company Ready July 2

The formal merger of the public-service corporations of Louisville, Ky., under the name of the Louisville Gas & Electric Company will, it is expected, be accomplished July 2, as meetings of directors of the companies interested have been called for that date, when the required consent of two-thirds of the stockholders should have been obtained. The component companies of the new merger are the Louisville Lighting Company and the Louisville Gas Company, which have been owned by H. M. Byllesby & Company, of Chicago, and the Kentucky Electric Company and the Kentucky Heating Company. H. M. Byllesby & Company have purchased the franchise offered by the city of Louisville at the upset price of $25,000, and agreed to a schedule of electric rates which had been discussed previously, so that there is no longer any obstacle to the formal consolidation. The city of Louisville is preparing to withdraw its suit to prevent the merger of the Kentucky Electric Company and the Louisville Lighting Company, a legal detail which will be accomplished without difficulty.

General George H. Harries, president of the Louisville Lighting Company and Louisville Gas Company, who is to be president of the Louisville Gas & Electric Company, expects the merger to become an active operating company by July 15. He has announced that none of the officials of the Kentucky Electric Company will be taken into the organization of the new company. This leaves Mr. Robert E. Hughes, president; Mr. L. S. Streng, chief engineer; Mr. C. C. Ousley, assistant to the president, and others at liberty. The consolidation will add but one new executive of importance to the present staff of the Louisville Lighting and Gas companies, Donald McDonald, president of the Kentucky Heating Company, who is scheduled to become vice-president and general manager of the Louisville Gas & Electric Company. Announcement has been made of the prospective retirement on July 1 of Mr. J. J. Humphreys, who has been chief engineer of the Louisville Gas Company, and Mr. A. T. Macdonald, head of the new-business department of the Louisville Lighting Company. Mr. McDonald will handle the details which have fallen to the lot of Mr. Humphreys heretofore, while the post of new-business manager will be abolished and the work distributed among other officials. The company's readable monthly publication, *Chained Lightning*, was recently discontinued.

The Standard Gas & Electric Company will be the holding company for the Louisville Gas & Electric Company. None of the stock of the latter will be marketed except that used in acquiring the Louisville Heating Company, the holding company of the Kentucky Heating Company, which is the gas company entering the merger. The stock of the Kentucky Electric Company, amounting to $3,600,000, has been practically all pooled with A. J. Carroll, attorney for the company, who will receive a check for $2,534,000 in payment for it, and distribute it among the stockholders. The stock is sold to the new company at $74 a share.

Public Service Commission News

NEW YORK COMMISSIONS

The Flatbush Gas Company has received special permission from the Public Service Commission for the First District to put into effect, seven days after publication, a supplement to its schedule of rates for motor service. The new supplement gives a schedule of discounts to be allowed on monthly bills ranging from 20 per cent on quantities between 100 and 200 hp-hr. to 83⅓ per cent on quantities in excess of 80,000 hp-hr. In its application the company states that recently it had a request from an ice manufacturer for the supply of electrical energy in quantities so large that it is necessary to extend the old scale of discounts to make an attractive rate to the prospective consumer.

The Public Service Commission for the First District has been served with a writ of certiorari issued by Supreme Court Justice L. A. Giegerich on the application of the Richmond Light & Railroad Company. The application asks for a review of the commisson's order of March 5, 1913, and March 15, 1913, requiring the completion of the double track on the company's street railroad line known as the Castleton Avenue or Brighton Heights line, between St. George, New Brighton and Broadway, West New Brighton, Staten Island. The writ is returnable in twenty days. In its application to the court the company alleges that its franchise permits it to operate either a single-track or a double-track line.

OHIO COMMISSION

The commission has refused permission to the Cleveland & Eastern Traction Company, of Cleveland, to issue $54,000 bonds to pay for a substation erected to utilize energy purchased from the Cleveland Electric Illuminating Company. The commission objected principally on the ground that there is no permanent value to capitalize and that this expense should be taken care of from the maintenance fund.

MARYLAND COMMISSION

The action of the Maryland Public Service Commission ordering a reduction in the rates for gas and electricity in Baltimore will go into effect on July 1, and the Consolidated Gas, Electric Light & Power Company is making preparations for a big increase in business because of the

new rates. In the electric division the standard maximum rate for service will be 8.5 cents a kw-hr., with a minimum charge of $1 a month. A rate of 10 cents has heretofore been in force. There is a change as to minimum charges. Formerly the minimum rate was $12 a year. Now it is $1 a month. It is considered likely that after the new rates have been in force for some months a movement will be started looking to the establishment of a sliding scale for gas and electricity.

Current News Notes

Automobile Lamps Too Powerful.—A Municipal Court judge in Chicago recently fined two men $5 and costs on the charge of having lamps on their automobiles so constructed and so equipped with reflectors that the light therefrom was projected more than 300 ft. from the machine.

* * *

Treasury Department Adopts Metric Weight for Diamonds.—Assistant Secretary of the Treasury J. F. Curtis has notified the collectors and other officers of the customs that on and after July 1 the unit of weight for imported diamonds, pearls and other precious stones will be the metric carat of 200 milligrams.

* * *

Norwegian-American Radio-telegraphy.—On June 20 the Norwegian parliament took steps to ratify a contract between the government and the Marconi company providing for a wireless service between Norway and America. Under the contract the Norwegian government is to spend $560,000 in the erection of a station at Stavanger which will be connected with a station at Boston.

* * *

Telephone Rates in Chicago.—Acceptance of the ordinance passed by the Chicago City Council on May 26 fixing telephone rates was filed by the Chicago Telephone Company on June 16. The main provisions of this new schedule of rates have already been indicated in this journal. The acceptance of the ordinance means that the rates of the Chicago Telephone Company in Chicago are fixed for the next five years, regardless of any action the Legislature may take in establishing a state public service commission.

* * *

Commission Form of Government for Cities.—At the recent session of the Illinois Legislature the law permitting the commission form of government for Illinois cities was amended so that after trying the commission plan cities can go back to the old plan of government by mayor and city council after a trial of two years rather than four years, as the law has read heretofore. Another amendment relates to the recall of municipal officers under the commission form of government. Hereafter an election contemplating the recall of municipal officers, except judicial officers, may be held on petition of 25 per cent of the registered voters instead of 50 per cent, as heretofore.

* * *

Proposed Electrical Display in New York on July 4.—A plan is on foot in New York City to do away this year with the municipal fireworks display and substitute for it extensive electrical illumination features, which it is thought will be equally spectacular and at the same time set an example for the more general adoption of the "safe and sane" celebration of Independence Day. An appropriation of $25,000 has been voted by the Board of Estimate for this purpose, of which it is reported that $10,000 will be devoted to the electric lighting display. It is understood that this money will be used in providing special illumination in various parks and for general electrical decorations. William R. Johnson is chairman of the illumination committee.

* * *

Terminal Situation in Chicago.—The Western Society of Engineers, the City Club of Chicago, the Cook County Real Estate Board and other organizations have asked the Chicago City Council committee on railway terminals to appoint an expert technical commission to make a thorough study of railroad terminal plans and proposals, recommending the plan which will serve best the future growth and development of the city. The matter was presented to the committee at a meeting held on June 23, but the aldermen did not seem to be impressed, declaring that the present subway and harbor commissioners of the city were competent to act as technical advisers. By a vote of nine to four the Council committee has expresssed its opposition to the idea of a central union passenger station for all the railroads.

* * *

Warning to Linemen Using Hemp Handlines.—One of the helpful suggestions which many of the delegates to the Chicago N. E. L. A. convention took home with them was the note of warning included in an experience related by Mr. W. L. Abbott, an operating engineer for the Commonwealth Edison Company. A lineman upon a pole threw a dry handline to a fellow workman standing on the ground underneath him. After falling the line lay across a 2200-volt lead. Although it was a perfectly dry day, the man on the ground picking up the line, supposedly of pure hemp, was instantly killed. Close examination of the hemp rope showed that each strand of it contained a single fine iron wire about the size of that used in lamp cord which had acted as a conductor for the current that had caused the fatality. It would be well for all central-station operators whose men use hemp handlines near high-voltage lines to examine these lines to prevent similar accidents.

* * *

Swords into Plowshares.—A regular army bayonet, converted from an instrument of war and destruction into an implement of peace and conservation, now forms part of the hand-telephone kit of every forest ranger in the United States Forest Service. These bayonets have binding posts fixed to their ferrules and are used as ground rods to establish a return connection with the single-conductor telephone lines which are being built through the wilds of the principal national preserves. The most important use for these lines is the reporting of forest fires. When a ranger wishes to communicate with headquarters he takes a coil of bare wire from his kit, throws it over the nearest telephone wire, and "saws" on the two ends until a good connection is established. Meanwhile his bayonet has been thrust deep into a moist place in the ground, and with the circuit thus completed the lonely wayfarer can talk with civilization, report his position or summon help.

* * *

SOCIETY MEETING

Electric Club Luncheon.—On June 19 a committee of the Electric Club of Chicago submitted a report on the pending patent legislation which contained a discussion of certain sections of the Oldfield bill and offered suggestions for improving the situation. Mr. Alonzo Burt, vice-president of the Chicago Telephone Company, who was the principal speaker of the day, cited some amusing occurrences in the telephone world and read an interesting paper on the organization of the telephone business. In this paper he said that "organization is most important next to capitalization" in any business enterprise.

Wiring of the Bankers' Trust Building

Features of the wiring installation and riser-shaft construction in a thirty-one-story office building on Wall Street, New York City

THE Bankers' Trust Building, No. 14 Wall Street, New York, is a thirty-one-story office building of 8000 sq. ft. floor area. Of the four basements the lowest contains the boilers and engines, while the main part of the third basement is occupied by the ventilating equipment. The floors above up to the third are used by the Bankers' Trust Company, and from fourth floor up there are rentable office floors.

Energy for lighting and motor service is supplied by one 100-kw, 250-volt, and three 150-kw General Electric two-wire generators directly connected to Corliss engines. The generators can carry 50 per cent overload for two hours and momentary overload of 100 per cent. Wiring for lighting is on the three-wire system, there being two balancer sets, each capable of taking care of 100 amp in the neutral. Wiring for motors is on the 250-volt, two-wire system. The main motor load consists of sixteen elevators, eleven being of the traction type, the ventilation system of the bank offices, and various motors operating vacuum cleaners, a pneumatic tube system and other appliances.

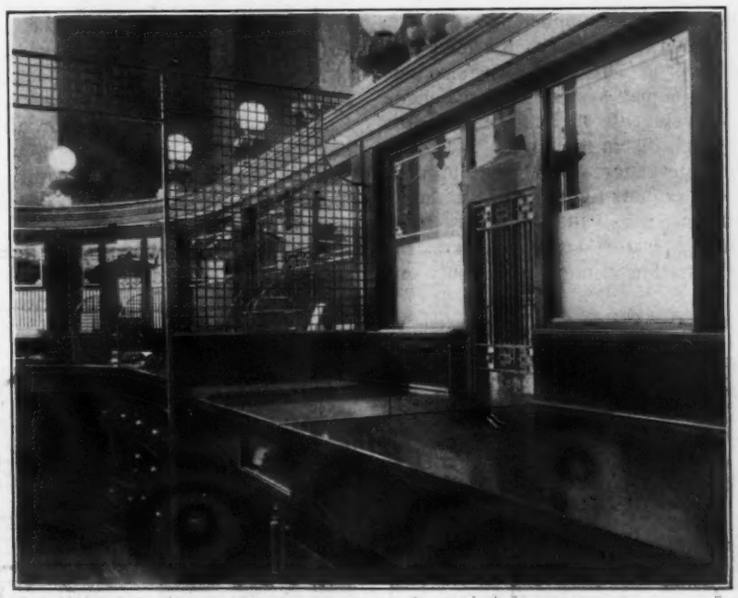


FIG. 1—ILLUMINATION FROM THE TROUGH ABOVE COUNTER

Two sets of generator busbars are provided. Each generator may be connected to either busbar through solenoid-operated switches controlled from a benchboard. The benchboard is in the form of a desk, on top of which are mounted the contact buttons. The switchboard was manufactured by the General Electric Company and is a remarkable piece of switchboard design and engineering. The generator buses are in the form of lead-covered cables and are installed in a subway under the engine-room floor. The lighting load is controlled by fused knife switches and the motor load through circuit-breakers. The ventilating fans are controlled from a sub-switchboard, the feeder to which may be connected to either the lighting or the motor bus.

A room which extends to the riser shaft is provided between the switchboard and the ceiling. In this room the riser cables are racked. These cables are in conduit supported at each floor by a 0.5-in. boilerplate drilled to receive the conduit. Cable support boxes are provided at intervals, the cables being supported by conical maple clamps. The panel boxes are installed in the riser shaft, a grill floor being provided at each floor.

The general distribution system for lighting on the rentable floors differs entirely from that employed in the Bankers' Trust Company quarters. In each bay there are five ceiling outlets connected together by conduits and with the four corner outlets connected to switch boxes on the columns. These outlets were fed from the switch box which was found best suited to the arrangements of each individual tenant and the other boxes were capped. Wherever necessary new outlets were installed and extended from the above. Each floor is provided with a hung ceiling space, and in making changes in the ceiling outlets it is necessary merely to cut a hole at the desired location and to fish a flexible conduit from the nearest present outlet. Four insertion receptacles are installed on each center column and two on each side column at the base. All outlets on the columns are so arranged that a partition can be located on the center or at either side of the column, as desired.

The various telegraph, telephone, ticker and other low-tension circuits are taken from a pull-box just inside the building at the first basement down to the third basement, where a separate room is provided for each class of service. The service pipes of the various companies supplying ticker service, for instance, are brought to separate boxes mounted on the wall of one of these rooms, and these boxes are grouped around and give access to a riser box. An exception to this arrangement is found in the room provided for telephone service, where connection strips are mounted on a rack.

For ticker, telegraph and messenger-call service there are provided seven rising cables, each opening in a junction box on each floor. These junctions are installed on the outside walls and are divided into sections, one for the cables mentioned and the other for telephone distribution service. The picture molding on every interior column is connected to both sections of one of the junction boxes by conduits. The molding is of large section and is used for sub-distribution either directly from one of the above junctions or from the conduit junctions to the interior columns. The telephone section of each of these junctions is connected by conduit to a main junction in the riser shaft at each floor. A 100-pair cable is carried in iron-pipe conduit from the telephone rack to the telephone junction on each of the rentable floors and headed up on interconnected strips. From these junctions the telephone company installs cables to the small junction boxes on the

outside walls and distributes from the latter by conduits to columns or picture moldings. Where a tenant's switchboard requires a cable larger than a fifty-pair one a conduit from the main junction in the riser shaft to the board is installed.

A No. 12 duplex conductor is carried up through two of the seven riser shafts to junctions on the outside walls and

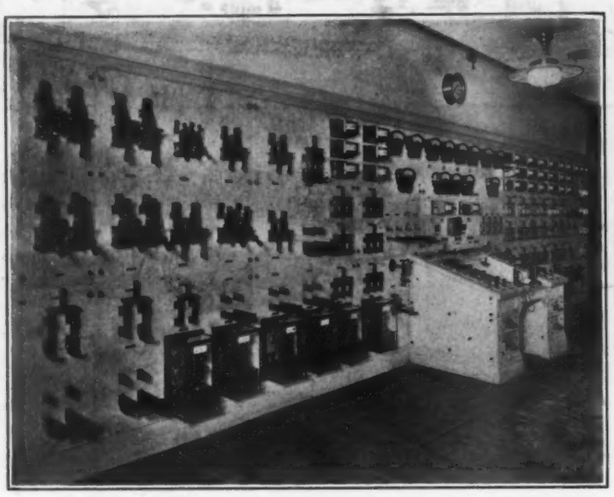
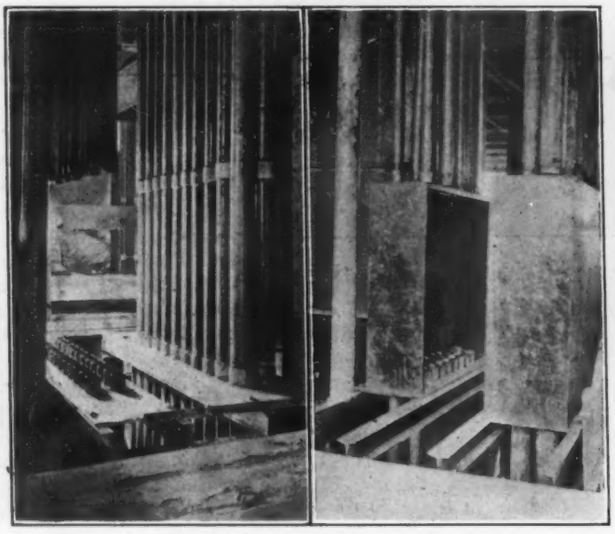


FIG. 2—VIEW OF SWITCHBOARD

also to the main junctions in the riser shafts for "battery" service. Energy for this service is supplied by two 250-watt, 240-to-30-volt motor-generator sets and a twelve-cell, 10-amp discharge storage battery. This equipment also supplies energy to the elevator-signal system and telephone system, the local telegraph system throughout the building and a system of emergency lighting in the engine and boiler rooms. The lamps of the emergency system are automatically switched on in case the regular lighting circuit should fail. Although the lighting circuits in the machinery room are connected back of the generator circuit-breakers, the emergency system is very desirable at night when only one generator is running.

Practically every tenant in the building has an extensive



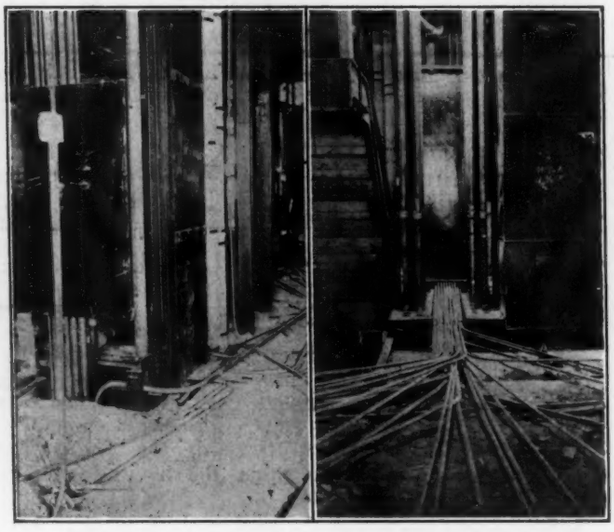
FIGS. 3 AND 4—DETAILS OF RISER-SHAFT CONSTRUCTION

call-bell system. In every case the circuits were installed by the electric contractor for the building under the direction of the engineers, this resulting in uniformity throughout. All wire is of No. 18 gage insulated with a 1/32-in cover of 30 per cent Para compound and an outside cover of a distinctive braid. All annunciators are of the De Veau

FIG. 5—MAIN BANKING ROOM, FIRST FLOOR

electrical reset type. Almost the entire building was rented before completion and all tenants moved in during three successive week-ends. As the final connections of the call-bell systems could not be made in many cases until desks were in place, this condition presented a serious problem. An elaborate schedule was made giving every desk a number, and before the desks were put in place all the material required for connection was packed together separately for each desk until it was needed. The extent of the system for some of the tenants may be judged from the fact that in several cases from 10,000 ft. to 12,000 ft. of wire was installed on a single floor and that some annunciators have as many as fifty-five drops. On one floor the system was so complicated as to require sub-junction boxes with interconnection strips to be installed with cables between and to annunciators.

The horizontal wiring for these systems was installed on the picture molding and in the conduits from junctions on the outside walls to the interior columns where these were available. From the picture molding down to the

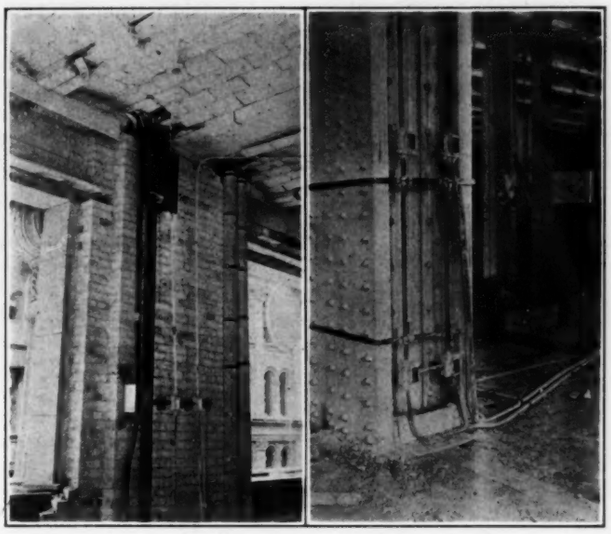


FIGS. 6 AND 7—RISER SHAFT AND BRANCH CIRCUITS

annunciators and desks use was made of conduits buried in walls or metal molding.

The picture molding is of steel, and although care was taken in mitering the corners many sharp edges were left. The call-bell wires were also disturbed by the various companies installing tickers and other wires in the molding, and

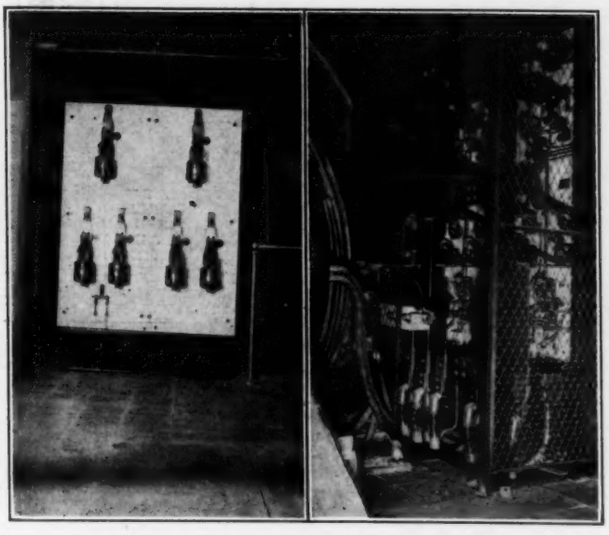
as a result grounds were frequent. The bell plant was therefore seriously loaded, and it was practically impossible to keep the system free from grounds. Finally a small fuse was installed at the points where battery service was taken off for each floor and the positive side of the battery system was grounded through a switch. In this manner the



FIGS. 8 AND 9—LOW-TENSION SUB-JUNCTION RISER AND CONDUIT WORK ON COLUMNS

trouble was cleared at once, because a ground on any floor opened the fuse at that floor. A complaint from a tenant then located the trouble. To keep the positive side of the system free from accidental grounds the permanent ground is transferred to the negative side at intervals.

The Bankers' Trust Company's quarters were treated in an entirely different manner from the rentable floors. The lighting is controlled from panels conveniently located, certain groups of lamps being controlled from separate sections or panelboards through remote-control switches. The lighting for these quarters is for general illumination only



FIGS. 9 AND 10—FRONT AND REAR VIEW OF GENERATOR PANEL

and all desks are provided with reflector fixtures manufactured for this purpose by the I. P. Frink Company. The counters behind the banking screen are lighted from reflectors at the cornice of the screen. The lighting fixtures on the first and second floors and in the public space on the third floor are of the alabaster-glass basin type. The center of the second-floor banking room is lighted indirectly by lamps equipped with reflectors placed on top of the screen partition and covered with colored glass screens. The remainder of the general lighting is of the direct type.

A gridiron system of conduits and floor boxes was provided for both the lighting and low-tension wiring of desks. Telephone and call-bell wiring is installed in the same conduits. This system was made necessary by the constant changes required in the arrangement of desks. The equipment of the offices was nearly doubled while the work was in progress. The shifting of a desk with connections of thirty or more wires from one side of the floor to another or to another floor was common. As the floor was of cork tile it was necessary merely to remove a few blocks, cut into the floor fill for a maximum distance of 36 in. to the nearest line of the system, and install floor boxes under furniture and in the gridiron system if none were convenient. The cork was then replaced, and the floor was not marred in any way by the change. A number of sub-junction boxes connected to each other and to annunciators and to main junctions by cables were installed at convenient points, and these boxes were connected to the under-floor system by conduits. To change the connections for a desk it was necessary merely to install wires from the new location to the nearest sub-junction box and to make cross-connections in other sub-junction or junction boxes.

Trunk cables are installed from a main telephone rack in the basement to the main junction in the banking quar-

FIG. 11—TYPICAL CEILING DISTRIBUTION ON RENTABLE FLOORS

ters, and all cross-connections are made in this box. There are two separate telephone systems operated from separate switchboards, one for interior and one for outside calls. In all cases only one instrument is installed on each desk and a transfer key is provided. On a number of desks there is also provided a "holding key" so that one line may be "held" while the other is connected to the instrument. In several cases visible signals are provided to indicate which line is calling and only one bell is provided.

The wiring in the underfloor system is Para insulated, except between junction or sub-junction boxes, where lead-covered, silk-and-cotton-insulated cable was used. In making connections to desks the cable from the floor was terminated on connection strips mounted on a short brass pipe. From this strip the connection to the desk was installed as a silk-covered cable. For lamp connection an insertion was installed in a small brass condulet, which was installed on a short brass pipe. This arrangement allows considerable latitude in the location of the furniture and also allows the furniture to be moved for cleaning without disconnecting the wires.

Annunciators are generally of the De Veau desk type with electrical reset, but use is made of several wall-type sets, some of which are equipped with lamps. Exclusive of lead-covered cables, 75,000 ft. of wire was used in the low-tension systems in the banking offices. The bank vault, which extends through the first and second basements, is

approximately 40 ft. square. Wiring for the interior was installed through channels cut in the plates when the vault was being built. These channels are staggered in successive plates. The wiring for lighting is controlled from two remotely operated switches, one for each level, and located outside the vault, so that when these are opened at night there is no current inside the vault.

The electrical equipment in this building was designed by Messrs. Henry C. Meyer, Jr., and Bassett Jones, associated consulting engineers, Architects' Building, 101 Park Avenue, New York City, and installed by the Lord Electric Company.

Electrical Rehabilitation of the Rock Island Railroad Shops in Chicago

Among recent improvements and additions made at the Forty-seventh Street shops and yards of the Chicago, Rock Island & Pacific Railroad in Chicago were the installation of a new generating plant, the replacement of steam-driven shafting by electric group drive and the rearrangement of the lighting distribution to meet present needs more efficiently. The changes were made primarily to avoid the smoke nuisance and also because the old generating equipment was entirely inadequate and so antiquated as to entail serious losses in operation. During the periods of maximum demand the pressure on the 110-volt lighting circuits would drop as low as 60 volts, owing to insufficient steam supply for the engines. The lighting and motor wiring throughout the buildings and yards was also in such poor condition as to necessitate immediate attention.

The task of rehabilitating the various facilities at these shops was intrusted to The Arnold Company of Chicago, the engineering being in the immediate charge of Mr. P. L. Battey and the supervision of construction in charge of Mr. H. H. Dickinson, of that company.

General Considerations

Group drive was considered preferable for the old machine tools owing to (1) the saving in the cost of new motors, (2) the utilization of the old shafting, and (3) the higher load-factor of operation obtained for each motor.

Interior lighting for the shops was laid out on the basis of 0.25 cp per square foot of floor area. This figure represents an average of 0.6 watt demand per square foot of floor area, which is slightly lower than the average of modern illumination.

The site chosen for the power plant is as close to the center of demand for steam, air and electrical energy as the surrounding conditions would permit. Owing to the nature of the soil, it was necessary to drive 200 piles, each at 2-ft. distances center to center, before the foundation was started.

The power-house building is a fireproof steel structure supported on concrete footings and walls, which extend up to the level of the generator-room floor. Fig. 3 is a view of the generator room, Fig. 1 is a general plan of the whole power house, and Fig. 2 is a cross-section. Concrete is used for the floors, roof, windowsills and copings.

Natural light for the generator room, which is 40 ft. by 90 ft., is provided by corrugated glass windows set in steel frames, which occupy the greater portion of three walls. White enameled brick is used for the wainscoting to a height of 6 ft., the floors and side walls being joined by a rounded concrete finish to prevent the accumulation of dirt. The floors have had a granite-chip finish to reduce the possibility of concrete grit getting into the bearings of the machines. Artificial light is furnished by ten 250-watt tungsten lamps.

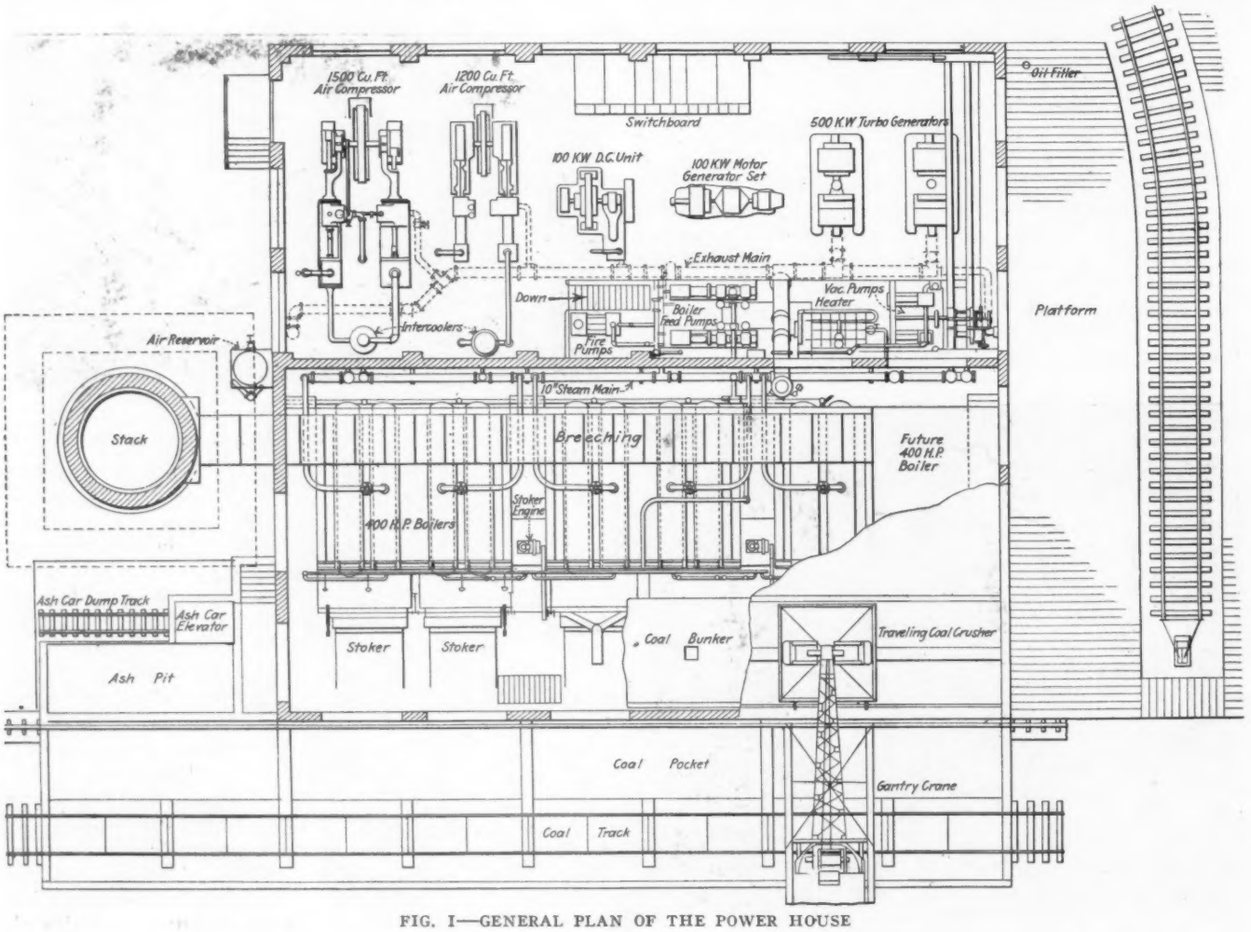


FIG. 1—GENERAL PLAN OF THE POWER HOUSE

ELECTRICAL EQUIPMENT IN POWER HOUSE

In the generator room are two 625-kva, 480-volt, three-phase, 60-cycle General Electric alternators directly connected to two non-condensing horizontal Curtis steam turbines running at 3600 r. p. m. Ventilating blades on the generator shaft maintain a circulation of air around the machine. The air used for cooling the generators is drawn in from outside through ducts. At the end of each turbine is a board on which are mounted a steam gage, a vacuum gage and a speed indicator which gives the percentage above or below speed. The turbo-generators are used for supplying practically all of the electrical energy used in the shops and yards. Fig. 3 shows one of these units, the motor-generator set, and the oil switches mounted back of the switchboard.

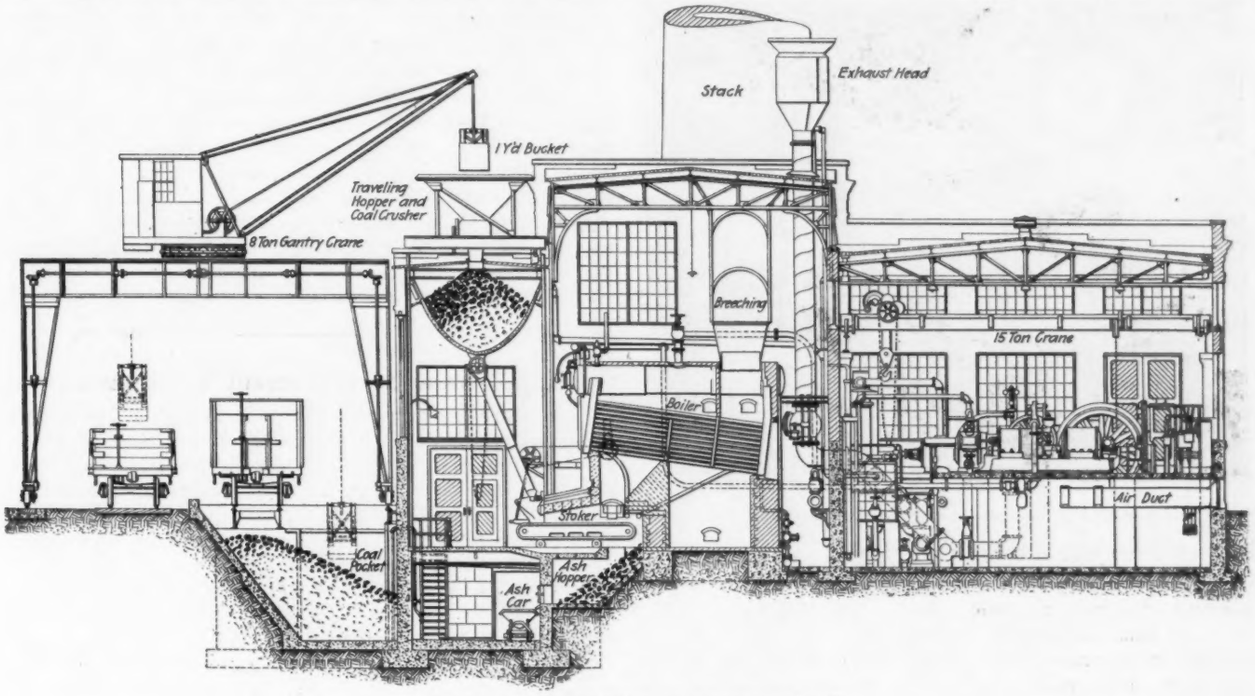


FIG. 2—CROSS-SECTION OF ENTIRE PLANT

In the middle of the room is a motor-generator set which runs at 900 r. p. m. This set consists of a 190-hp, 480-volt, three-phase, 60-cycle synchronous motor; a 100-kw, 220-110 volt interpole, compound-wound, three-wire-system generator and a 25-kw, 125-volt interpole, compound-wound generator for excitation service. The 100-kw, 220-110-volt generator which is also directly connected to the synchronous motor is used for supplying energy for the three-wire direct-current lighting system and for direct-current motors in the shops.

In addition to the generators mentioned, there is a 100-kw, 250-volt Westinghouse direct-current generator directly driven by a 150-hp Ideal steam engine, which runs at 275 r. p. m. This set is one of the few pieces of the old equipment which were found in condition to be utilized. In case the alternators are shut down temporarily for any reason and it is desired to furnish them with exciting current, the 220-110-volt generator of the motor-generator set is operated as a motor by energy supplied by the steam-driven 100-kw generator.

The small steam-driven generator may be used to carry the direct-current load alone in case the motor-generator set becomes inoperative, or may be operated in parallel with it.

SWITCHING AND CONTROL EQUIPMENT

A sixteen-panel black-slate switchboard is supported on a frame of steel tubing on the east side of the generator room. The panels, which are equipped with the usual apparatus and switches, control the generating units mentioned and also serve to distribute energy for lamps and motors in the various shops. On the panel controlling the synchronous motor are two handles actuating remote oil switches for the starting and running conditions of the motor. On starting, the fields of the machine are left open-circuited, and the motor is brought up to speed by induction-motor action. When the running switch is closed and the starting switch is opened the motor runs as a synchronous machine. An automatic trip operated by a time-limit relay allows the switch to open in case there should be an excessive overload.

Switches are also arranged so that the 125-volt direct-current generator can be run in parallel with one side of the three-wire-system 220-110-volt generator. The load can be arranged so as to insure that this system will not be unbalanced.

One of the panels has been installed recently to supply energy for the signal department. A three-blade, double-throw switch permits of supplying this department with energy from either the three-wire direct current or the three-phase system after it has been stepped down to 220-110 volts. The voltage of the alternators is kept constant by a General Electric voltage regulator.

SOME MECHANICAL FEATURES

Besides the electrical equipment, there are in the generator room two steam-driven air compressors, which were among the old equipment. These are capable of compressing 1200 cu. ft. and 1500 cu. ft. of air per minute respectively. A 15-ton hand-operated crane runs on tracks laid lengthwise of the room.

Besides supplying steam for generating the electrical energy, the boilers installed at this plant have to furnish steam for heating coaches, for blowing engines (when they are being fired in the roundhouse) and for running pumps and accessories. The possibility of utilizing as a condensing-water supply water required for locomotives at the roundhouse was considered, but, as the period of demand for locomotive water does not coincide with the period of demand for condensing water, it was found that it would be necessary to build a large storage reservoir. This would necessitate a large additional expense not warranted by the

added economy of condensing. The exhaust steam is utilized for the heating system during cold weather.

Steam Raising and Fuel Handling

Five 400-hp boilers with 4080 sq. ft. heating surface are installed in a 44-ft. by 90-ft. room adjoining the generator

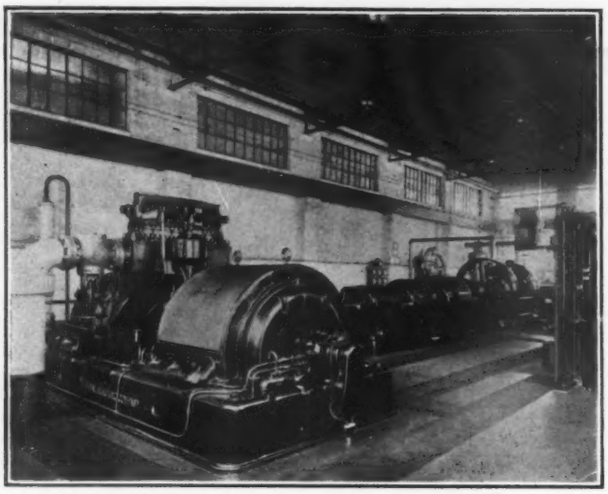


FIG. 3—GENERATOR ROOM IN POWER HOUSE, ROCK ISLAND RAILROAD SHOPS

room. Special attention was paid to the design of the combustion chambers, which are of the Dutch-oven type so as to insure smokeless combustion. The throat of the combustion chamber is flared, but is kept at a small cross-section so as to make the velocity of the gases high. A baffle placed in the path of the gases deflects any unburned particles back into the furnace, where they are consumed. After installation it was found almost impossible to force the boilers above their rating, owing to the design of the combustion chamber. To remedy this, the arches of two

FIG. 4—GANTRY CRANE FOR COAL HANDLING

boilers have been raised, increasing the cross-section and allowing the boilers to be forced above rating. This is being done tentatively, however, subject to the approval of the city smoke inspectors, on condition that the change shall not prevent practically smokeless combustion.

Fuel handling at this plant presents some interesting features. Underground concrete hoppers having space for 500 tons of coal were built adjacent to the boiler room (Fig. 2). Coal is unloaded directly from hopper-bottom cars on a track immediately above the bunkers or else by means of an electrically operated gantry crane, shown in Fig. 4. This crane is also available for handling shop material from cars on a track paralleling the power house, storehouse and forge shop. The underground bunkers are divided into separate compartments by concrete walls and are supplied with water-piping connections for drawing off or transferring from one compartment to another. From the outside bunkers the coal is transferred by the crane to a hopper and coal crusher traveling on rails on the roof of the boiler room. This crusher runway is immediately above the overhead inside coal bunkers, and the latter are large enough to contain 200 tons of coal in addition to the 500 tons in the underground bunkers. Ashes are taken to a pit by dump cars and thence loaded into railroad cars by means of the gantry crane. One 37-hp induction motor performs all the operations on this crane.

High-Tension Direct-Current Transmission

In a paper presented by Mr. J. S. Highfield before the joint meeting of the British Institution of Electrical Engineers and the French Société Internationale des Électriciens in Paris, on May 21 to 24, was discussed the transmission of electrical energy by continuous current using the series scheme. A detailed description was given of the Thury high-tension system of operation with series generators and motors. Data were also presented comparing the cost of three-phase alternating-current and series direct-current transmissions for various line pressures. There are examples given which make it evident that in many cases the cost per kilowatt-mile of overhead lines is indeed greater than the cost of the continuous-current underground-cable system. While such is not invariably the case, it is interesting that in some cases this result is shown. The underground system permits the use of cables in cities where overhead lines would be prohibited. Such cables are also safe from damage and involve less maintenance expense.

In conclusion, the author enumerated the following advantages of the direct-current series system: (1) The cost of the line is less than the cost of a line of similar capacity for alternating current, more particularly where underground transmission is desirable. (2) By the use of the earth as one of the conductors a very large saving in the cost of the line can be made, a saving not possible with alternating current. (3) The switch gear and switching operations are very simple. (4) The operation of several stations in series is less difficult than the operation of several stations in parallel. (5) The uniform section of the cable permits of an increase in load, supplied at first from one point, to be readily provided for at the other suitable points on the line by other stations, without adding to the cable system. (6) Very efficient speed regulation of the motors is obtained.

Opening the discusssion, Mr. Thury said that, as a sort of confesssion of faith he would himself admit that the applications of the series direct-current system are limited. Constant potential remains the system for distribution, and alternating-current transmission suits this in most cases. The series system is advisable, however, for very long-distance transmission and when underground cables are desirable. For distribution the series system is limited to cases in which there are only a few consumers of large size. It has also enabled problems to be solved which would be impossible with alternating current. For instance, in crossing small stretches of sea in an American installation, series operation was adopted because the cable makers would give a guarantee only in the case of single cable. Tests show that direct-current cables absorb a negligible

amount of energy, and this is confirmed by its being possible to test them with a small electrostatic machine. At Lyons it was found that a cable with insulation only 0.07 in. thick would stand 300,000 volts. Mr. Thury placed the limiting size of generator at a higher figure than Mr. Highfield and referred to a recently developed scheme involving the use of 5000 kw divided between two armatures.

In answer to a question by Mr. Claude, Mr. Thury said that no electrolytic troubles occur in the cables, since by the process of manufacture there is no trace of moisture in them.

Mr. Boissonos described a special case in which several generating stations were wanted, and although it would have been possible to run them in parallel, it was yet deemed advisable to make use of the high-tension direct-current system. The arrangement ultimately decided upon was to have two groups of stations, three high-tension direct-current plants and three three-phase plants, the two groups being interconnected and working on to the same distributing network.

On the St. Maurice and Lausanne system, Mr. Thury said that iron earth-plates were used which, although they should theoretically have been destroyed by electrolysis in less than two months, nevertheless worked as well after a year as they did on the first day, owing to the formation of a protective film of oxide iron. No electrolysis of pipes had been noticed. If necessary, one might have to go several miles to find a place for a good ground.

Mr. J. F. C. Snell said that while the series system simplifies distribution, it complicates the generating system. The small size of units is one of the difficulties.

Mr. F. C. Raphael remarked that in case of a ground on the cable the automatic regulator in the station would continue to maintain the current at its regular constant value no matter how large a proportion was leaking at the fault, so that the result would be an enormous drop in pressure at the substations and consumers' connections.

Mr. Thury said that he had had practically no experience with faults on the line. He recalled only two cases in which he had had to shut down the generating station in consequence of them. He mentioned one other case in which a fault had been sufficient to set fire to the pole and burn it through, thus re-insulating the line, as the upper part remained suspended in the air.

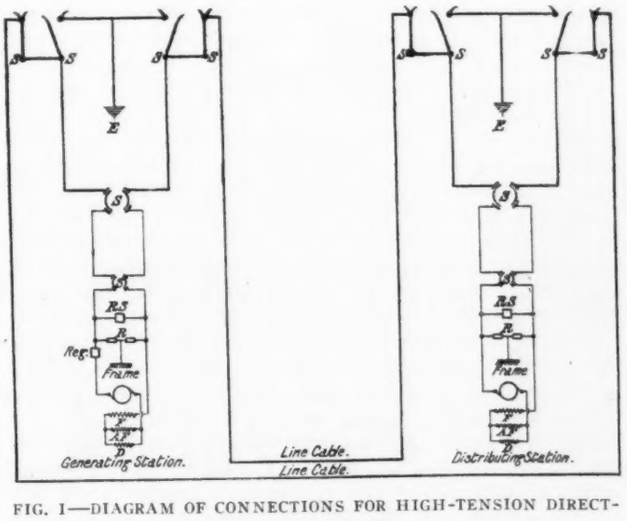


FIG. 1—DIAGRAM OF CONNECTIONS FOR HIGH-TENSION DIRECT-CURRENT SYSTEM

Mr. Roger Smith said that 1200 kw is about the power needed for an average freight train, and that this rating would be a suitable unit for motor-generators on a railway system. One earth return, he said, had been flowing for months under the Great Western Railway, where earth returns were used for the signaling and where telephones were worked at a pressure of only 2 volts, but no trouble had been experienced. Mr. Smith said he was impressed by the simplicity of the substation arrangement. Adjoining some of the substations there were allotments which were so well

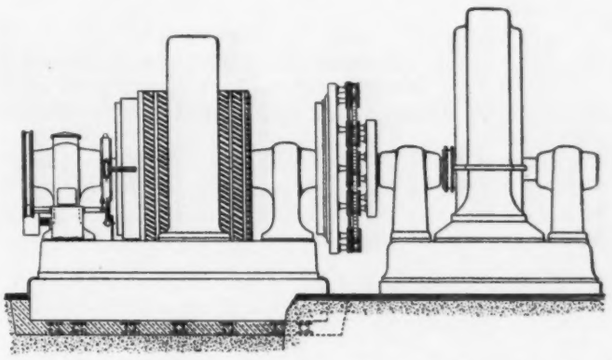


FIG. 2—INSULATED FOUNDATION FOR MOTOR-GENERATOR

kept that he thought the attendants worked almost more in the gardens than in the substations.

Mr. B. M. Jenkins said that he was struck by the great simplicity of the switchboard.

The Rating of Induction Motors

BY ALEXANDER GRAY

If the rating of induction motors is changed from one with an overload guarantee to a single rating with no overload margin, certain changes will be made in the design of the machines.

The standard induction motors now on the market are able to carry full load continuously with a temperature rise which is less than 35 deg. C. and can also carry 25 per cent overload continuously with a rise in temperature of less than 50 deg. C.

The present tendency of the manufacturers, and it is a reasonable one, is to rate electrical machinery at the load

TABLE I—GUARANTEES UNDER DIFFERENT METHODS OF RATING

	Rating with an Overload	Single Rating
Horse-power	15	19
Speed in r.p.m.	1150	1135
Efficiency:		
Half load, in per cent	86	87.5
Three-quarters load, in per cent	88	88
Full load, in per cent	87.8	86.8
One and a quarter load, in per cent	86.8	....
Power-factor:		
One-half load, in per cent	76	81
Three-quarters load, in per cent	84.5	88
Full load, in per cent	88.5	90.5
One and a quarter load, in per cent	90.5	..
Temperature rise at full load, in deg. C	35	50
Starting torque, times full load	1.8	1.45
Starting current, times full load	5.8	4.7
Maximum torque, times full load	3	2.4

which it can carry continuously without the rise in temperature of any part exceeding a safe value. For ordinary insulation this value is generally taken as 50 deg. C.

If this latter system of rating be adopted, as is proposed by the standardization committee of the American Institute of Electrical Engineers, it seems that the only change required in standard motors is a change of name-plate, the rating being increased 25 per cent. For example, a motor which is now rated at 10 hp with a temperature rise of 35 deg. C. would have its name-plate changed and would be rated at 12.5 hp with a temperature rise of 50

deg. C., but it would be the same machine as before and would therefore be expected to do the same work and no more. It is the purpose of the present article to point out that other changes will be made, which will compel the use of temperatures higher than those now found in standard machines.

Fig. 1 shows the "circle diagram" for a 10-hp standard induction motor. The guarantees which would be made on this machine under the two methods of rating are given in Table I, it being assumed that the motor is the same in each case.

The guarantees based on the single rating show a smaller starting torque, a higher half-load power-factor and a lower full-load efficiency and speed than is expected by the purchaser. In an endeavor to make these guarantees

TABLE II—VARIATION WITH DIFFERENT WINDINGS

	Old Winding	New Winding
Horse-power	19	19
Speed, in r.p.m.	1135	1145
Efficiency:		
Half load, in per cent	87.5	87
Three-quarters load, in per cent	88	88.5
Full load, in per cent	86.8	88
Power-factor:		
One-half load, in per cent	81	76
Three-quarters load, in per cent	88	85.5
Full load, in per cent	90.5	88.5
Temperature rise at full load, in deg. C	50	45
Starting torque, times full load	1.45	1.7
Starting current, times full load	4.7	5.7
Maximum torque, times full load	2.4	2.9

more attractive the flux per pole will be increased by decreasing the number of conductors and the size of each conductor will be increased so as to keep the total weight of copper constant. The characteristics of the machine will then be changed in the following way:

The starting torque will be increased since it is proporional to the square of the flux. Full-load current in the rotor will be obtained with a smaller slip and therefore the full-load speed will be increased. The core loss will be increased because of the increase in flux; the copper loss will be decreased because of the decrease in the number of conductors and the increase in their cross-section. The efficiency will be increased and therefore the temperature rise will be less than 50 deg. C. The magnetizing current will be increased and the power-factor at fractional loads decreased.

Fig. 2 shows the circle diagram for a 15-hp standard motor when wound with 10 per cent fewer conductors of 10 per cent larger cross-section than standard, the rotor being unchanged.

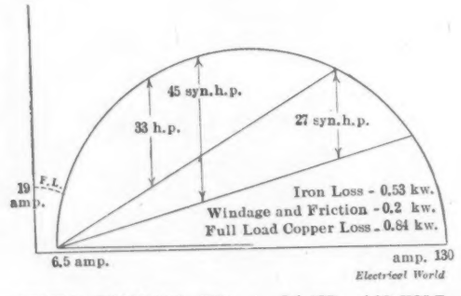


FIG. 1—CIRCLE DIAGRAM FOR A 15-HP, 440-VOLT, THREE-PHASE, 60-CYCLE, 1200-R.P.M. MOTOR

From these figures it may be seen that the machine with the increased flux has more attractive guarantees than the machine which has the winding unchanged. Thus the tendency under the single rating will be to produce machines with flux densities which are higher than those at present in use.

The statement is often made that in changing from the present rating with an overload guarantee to a single rating with no overload guarantee motors will be rated 25 per cent higher but will be used for the same load as before. If, however, the flux is increased, as is sure to be the case in order to make the guarantees as attractive as possible.

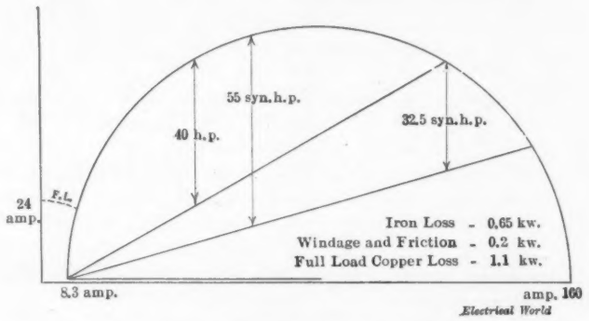


FIG. 2—CIRCLE DIAGRAM FOR A 19-HP, 440-VOLT, THREE-PHASE, 60-CYCLE, 1200-R.P.M. MOTOR

then, in order to show a high power-factor at light loads, the average load on the machine must be greater than at present. Therefore preparation should be made for the higher operating temperatures which are certain to follow.

Hydroelectric Station for Construction Purposes

In connection with the construction on the White Salmon River, Washington, 75 miles east of Portland, Ore., of the 20,000-hp hydroelectric development it was found necessary by the Stone & Webster Engineering Corporation to establish a temporary hydraulic plant for the purpose of furnishing electricity for carrying on the work incident to the building of the large plant.

A flume 9 ft. 3 in. wide, built of wood, diverts water from the stream right through the new 125-ft. dam now in process of construction, carrying it to a point a few hundred feet below the dam where the small wooden power house has been established. The prime mover is a 54-in. turbine built by the S. Morgan Smith Company, York, Pa., operating under a 13-ft. head and capable of delivering a maximum of 300 hp. The turbine is directly connected to a generator rated at 150 kw and 440 volts and the electrical energy is used for various purposes on the immediate work, including quarrying on top of the hill 400 ft. above the dam, operating concrete mixers, lighting, drilling, etc. It is also used at a point more than a mile down the river where the power house is being built, to which point it is transmitted at 6600 volts. The depth of water in the flume is kept at 6 ft. by an ingenious arrangement of gates such that when the water falls below 6 ft. a by-pass is closed and the flow is built up; when the water tends to exceed 6 ft. the by-pass is opened wide and the excess water is thrown into the bed of the stream between the big dam and the temporary power house.

The main development, which is to be operated by the Northwestern Electric Company of Portland, will have a head of 175 ft. and an impounded volume of 40,000,000 cu. ft. of water. This water is gathered from a drainage area of 350 sq. miles and is held back by a concrete dam of the solid gravity type, 470 ft. long with a 250-ft. spillway 125 ft. in height. Water will be carried from the dam to the power house by a wood-stave pipe 5100 ft. long and 13.5 ft. in diameter, emptying into a concrete forebay. From this point two pressure pipes 700 ft. long and 9 ft. in diameter will give the operating head of 175 ft. Part of the energy will be used near by and part transmitted to Portland for general lighting and industrial purposes.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

"Home-Made Week" at La Crosse, Wis.

"Home-made Week" was celebrated by the people of La Crosse, Wis., during the closing days of May. For the time being the merchants of the city gave up their show windows to the manufacturers, nearly a hundred of whom

"HOME-MADE WEEK" EXHIBIT OF LA CROSSE COMPANY

took advantage of the opportunity to have their products made better known locally. Among the prominent displays was that of the La Crosse Gas & Electric Company, which occupied a corner building and was brilliantly illuminated. The accompanying illustration shows the window exhibit of the central-station company, which included an electric dining room, complete with toaster, percolator, stove, fan, etc. Mr. Thurston Owens is manager of the La Crosse Gas & Electric Company.

Jurisdiction of Public Service Commissions

The Indiana Railroad Commission having issued an order directing the placing of headlamps of not less than 1500 cp on locomotive engines of railroad companies operating in Indiana, suit was brought by the Vandalia Railroad Company to enjoin the enforcement of this order and the collection of penalties for failure to comply. Judgment was rendered for the defendant and the case was appealed. Judge Erwin, of the Indiana Supreme Court, in affirming this decision (101 N. E. 85), gave the following opinion: (1) All powers not delegated to the federal government by the Constitution are reserved to the states. (2) The states have full power over intrastate commerce and may pass such laws regulating the same as they may deem expedient. (3) Since Congress had passed no law covering the same field, the Indiana Legislature had power to pass a law authorizing the Indiana Railroad Commission to prescribe and require the use of headlamps on locomotives, even though this might affect interstate commerce. (4) The granting of such power was not equivalent to investing the Railroad Commission with legislative powers. (5) The act granting such power was not unconstitutional as being a law which in order to take effect depends on any authority. (6) The act was not objectionable on the ground that its subject was not contained in its title. (7) It is not essential to a valid title to a statute that the subject be expressed in exact terms if it is fairly deducible from the terms employed. (8) Since a supplementary law gave to the railroad company the right to have orders of the commission reviewed in the proper court, the act in question was not unconstitutional as depriving the railroad of its property without due process of law. (9) The passing of said act was a proper exercise of the police power of the State. (10) An order of the Indiana Railroad Commission requiring the placing of headlamps of not less than 1500 cp was not fatally defective through uncertainty or indefiniteness.

A 13,200-Volt, 2-Mile Transmission for City Factory Service

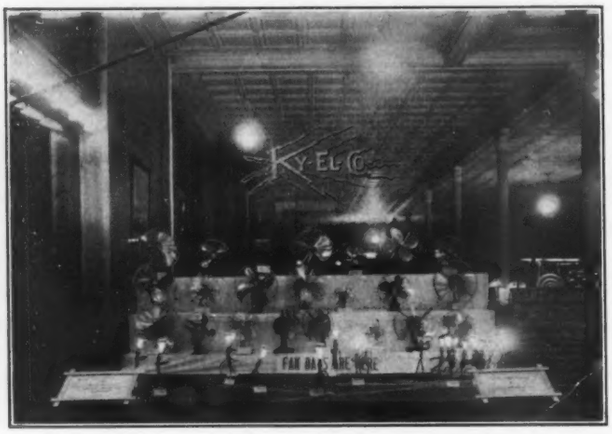
The increasing motor-service load of the Worcester (Mass.) Electric Light Company has made it necessary to build a 1500-kva substation in the heart of the city to handle the service in factories near the business district. The company's main generating plant at Webster Street, 2 miles from the center of the city, delivers energy to the distributing system at 2300 volts, but the size of the factory load in the vicinity of the substation necessitated the inauguration of a 13,200-volt transmisssion. The substation is now under construction and is a 22-ft. by 25-ft. brick building, with concrete floor and roof, at the intersection of Southbridge and Sargent Streets close to a number of metal-working and textile industries. It will contain three 500-kva transformers with a five-panel switchboard and single set of buses and will supply energy over local three-phase and single-phase 2300-volt lines for both motor and factory lighting service. Three underground cables will connect the substation with the Webster Street plant. The unusual feature of the work is the use of a 13,200-volt transmission for so short a distance, to enable the company to serve economically a district of dense motor-service requirements.

Electric Business in Clifton Forge, Va.

The Virginia-Western Electric Company owns the franchise for furnishing electric service in Clifton Forge, Va., which expires in 1937. The city has a population of 6500, of whom about 1000 are colored. It is chiefly a railroad town built around the shops of the Chesapeake & Ohio Railroad Company, so that heavy consumption of electricity cannot be expected. However, there are over 700 meters installed and there are over 400 flatirons used on the circuits. The rates for energy for lighting service range from 10 cents to 6 cents, and the rates for energy for motor service range from 5 cents downward. The city contract calls for fifty-eight 6.6-amp inclosed-arc lamps at the rate of $50 a year, all-night service. In addition the company supplies the service for forty-one arc lamps to the Chesapeake & Ohio Railroad Company. Most of the meters are on the front or back porches of houses. No minimum charge is in vogue. At the present time the maximum load on the steam station is approximately 400 kw. The day load, made up chiefly of motors in the shops of the Chesapeake & Ohio Railroad Company, is about 200 kw. The latter company because of its consumption obtains a rate of 5 cents per kw-hr. for lighting service and 1.75 cents per kw-hr. for motor service. Mr. W. G. Mathews is president of the Virginia-Western Electric Company and Mr. A. C. Ford is secretary-treasurer and general manager.

An Electric Ball-Game Window Display

The accompanying illustration shows the ingenious lamp and fan window display of the Kentucky Electric Company, Louisville, Ky., mention of which was made in these columns June 14. The players are represented by incandescent lamps mounted on black-wire bodies and legs in most life-like poses, and the contest is between the "Tungsten" and

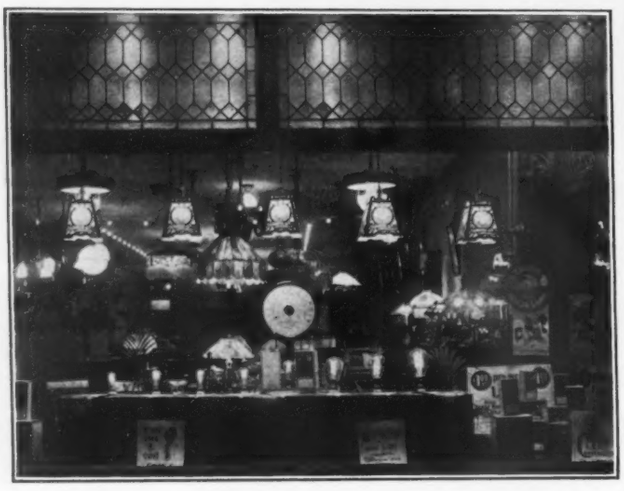


ELECTRIC BALL-GAME WINDOW DISPLAY AT LOUISVILLE, KY.

the "Carbon" teams, with the former winning three to one. A frosted lamp personifies the umpire. During the exciting moments of the game the electric "fans" grouped on the bleachers give vent to their enthusiasm by spinning wildly with much breezy chatter. A flasher mechanism beneath the diamond controls the lamps and fans to produce the effects described. Local interest is added by dubbing the winning nine with the names of the Louisville team, while on the grand stand are those of well-known enthusiasts.

Counting the Cost to the Customer

The passer-by who tarries for a minute in front of the display window of the Metropolitan Electric Company of Reading, Pa., can learn just what it costs to run each of



A "LOW-COST-OF-LIGHTING" WINDOW DISPLAY AT READING, PA.

the various lamps there shown, ranging from 25 watts to 250 watts, as they are flashed on in succession by a motor-driven switching device. A Donkin "cent-hour-meter," which forms the central feature of the exhibit, is connected in circuit with the various lamps as they are lighted, so that the pointer indicates directly the number of cents per hour it costs to operate each unit.

The display includes both tungsten and carbon lamps, affording the layman an opportunity to compare the energy consumption of each, and thus to confirm the statements he has heard or read. All the lamps are fully labeled with explanatory legends detailing the wattage, candle-power, etc., of each and directing attention to the reduced energy consumption of the modern high-efficiency units. The attractive window display of the Metropolitan Company is shown in the accompanying illustration.

Electric Pumping Outfits at Stockton, Cal.

In San Joaquin County, Cal., in which Stockton is located, the underground water level is so near the surface that it is found cheap to raise the water by electric pumping for use in irrigation. Accordingly more than 300 electric pumping outfits are in operation in San Joaquin County and the surrounding territory, operated from the lines of the Western States Gas & Electric Company. Since the beginning of 1913 the company has gained 2250 hp in motor business.

Oakland's Bid for Manufactures

Every progressive community is anxious to have factories located within its bounds and will do everything possible to promote their welfare. That the Pacific Coast must become

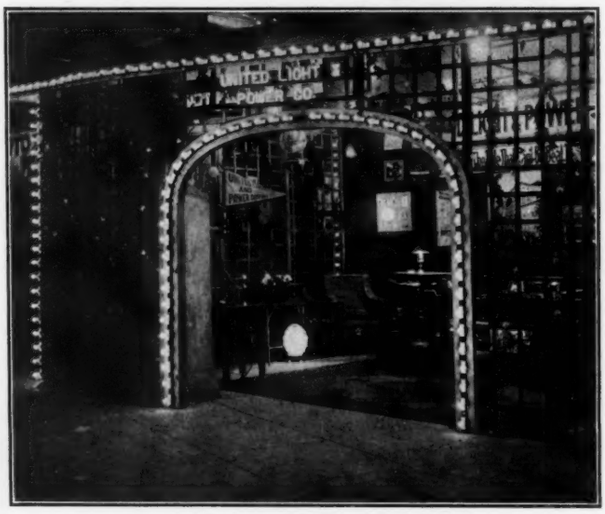


FIG. 1—ENTRANCE TO ELECTRICAL BOOTH, OAKLAND MANUFACTURES EXHIBIT

a great manufacturing community in order to supply the wants of the millions of people who will settle there in the near future is keenly appreciated by the coast cities and they are exerting themselves to attract these industries to their own particular fields. Electric service companies are not usually classed as manufactories, but their officers realize the great benefits to be derived from association with and promotion of all civic organizations working for the development of manufacturing. During April the manufacturers' committee of the Oakland (Cal.) Chamber of Commerce held an exhibition of products manufactured in the county.

The United Light & Power Company of Oakland was represented by a unique exhibit, installed in an artistic low-roofed garden house, constructed of green lattice-work having 6-in. squares, interwoven throughout with strands of autumn leaves. The interior was lighted by 60-watt ceiling lamps and reflectors. In the background a large glass showcase contained a great variety of electric appliances, and on the wall behind it were shown photographs

of buildings using the company's steam and electric services and other photographs of local interest. The attractiveness of the booth was augmented by the presence of artistic wicker furniture, and electric "glows" placed near by created an atmosphere of warmth and coziness.

An interesting feature was a large wooden panel displaying sample tungsten lamps of all sizes and types known.

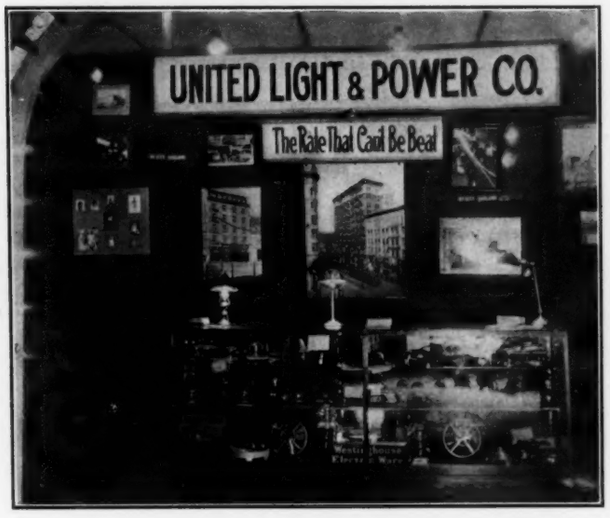


FIG. 2—DISPLAY OF UNITED LIGHT & POWER COMPANY, OAKLAND, CAL.

The transformer supplying the outlining lamps was installed in the open to demonstrate its use, while near by was placed a glass-covered meter to register the consumption of the various lamps and appliances, also instructing visitors how to read their own meters. A utility table displaying various electric-driven kitchen utensils proved a center of attraction to the women. A small working installation consisting of a steam radiator, regulating valve and condensation meter attracted attention to the company's steam service and illustrated the use of the atmospheric pressure system of steam heating and metering. Four attendants were on duty to explain and operate the appliances.

Motor Driving in Envelope Factory

In the following paragraphs are given the outlines of an investigation of the cost of central-station service in an envelope factory driven partly by a steam engine. The installation consists of a 75-hp Putnam simple engine located in the basement of the factory, which is a four-story structure, and driving up through to the main shaft on the second floor. From this main shaft are four principal drives, and an auxiliary 30-kw, 125-volt direct-current generator is also belt-driven from it. Of the main drives, the first consists of a long belt with countershafts taking up a considerable amount of valuable space and head room and extending to a main shaft on the third floor which drives the machinery in the so-called rotary department, a blower and two exhaust fans, besides two slitting machines and an agitator. The second drive consists of one line shaft on the second floor of the plant from which are operated five Harris presses. The third drive consists of two counter shafts, both in the basement near the engine and operating two small pumps, and the fourth drive goes to the third story, operating the machinery in the envelope, folding and cutting rooms, carpenter shop, box department and elevator, the last being of 1000-lb. rating and serving the entire plant. At present the machines in the baling press department, universal department and machine shop are operated by an installation of 32.5 hp in direct-current motors, supplied with energy from the above-mentioned generator, the average load of these divisions being 12.5 kw.

The motor-service survey by the central station indicated the desirbability of installing motors in the different departments, using three-phase induction units throughout, with 550-volt service, driving the present countershafts at the speeds now used. The operation of the two small pumps in the engine room by groups from a 2-hp motor was advised. The rotary-room equipment containing five candy-bag rotary machines, seventeen writing envelope machines, one small lathe and two slitting machines, can be operated by a 10-hp motor. The fans and blower can be handled by a 15-hp motor. The machine shop, containing eight or ten small tools including the usual lathes and drills, grinders and planing equipment, can be handled by a 5-hp induction motor in place of the present machine. The engineers of the central station pointed out to the plant owner that by installing a countershaft in this department between the motor and the line shaft a higher speed motor can be used at a considerable reduction in cost, since the price of a 5-hp motor running at 720 r.p.m. is about $150, while the cost of a 1130-r.p.m., 5-hp motor is only about $100.

To operate the apparatus in the envelope and cutting departments, including fifty-three envelope machines and seven cutters, a 25-hp, 1130-r.p.m. motor was advised, with countershaft between the motor and the present low-speed line shaft. The "universal" department, containing seven special "universal" machines, requires a 5-hp, 750-r.p.m. motor-belted directly to the line shaft, and the printing department, containing twenty job presses, calls for a 7.5-hp motor. Other motor applications indicated as desirable are: In the baling shop, one baling press is to be gear-driven by a 5-hp induction motor; a Hamblet shear is to be driven by a 3-hp induction motor in place of a 5-hp direct-current motor now used, and five Harris presses are to be run by a 3-hp, 1120-r.p.m. motor on the ceiling of the floor below the presses and belted to the present line shaft. A Staude machine is also to be operated by a 5-hp, 900-r.p.m. motor of the slip-ring type, giving a 50 per cent speed reduction. The carpenter shop, containing one 16-in. rip saw, one 12-in. jointer, one pattern lathe, a jig saw and a planer, may be served by an independent motor, or, as seems desirable in the preliminary installation, by a motor of 7.5-hp rating, which will also drive the elevator and the machinery in the box department, the latter including three scoring machines, one cutter, one box machine, one automatic ending machine, one agitator and six small machines of nominal loads.

The motor-service survey indicated the present desirability of an installation of twelve motors of 93-hp rating, with the purchase of three 5-kva transformers of 550-to-110-volt ratio for factory lighting. The estimated cost of installation was: Motors, $1,985; erection of motors, $400; transformers, $195; total, $2,580. Assuming from tests that the maximum demand during the six winter months is 61.25 kw and the average demand 46.65 kw, with 1375 operating hours, the cost of electrical energy on the above basis will be $1,422.47. Assuming for the six summer months from tests that the maximum demand will be 55 kw and the average 40 kw, with 1375 operating hours, the cost of energy will be $1,232.55, or a total of $2,655 per year. In the winter period the energy consumption is estimated at 64,143 kw-hr., and in the summer at 55,000 kw-hr. The load-factor of the motor installation in the summer half-year is estimated at 50 per cent.

The estimated total yearly operation by steam was 3.27 cents per hp-hr., as compared with a cost of electrical operation of $4,104, or 2.57 cents per hp-hr., including the following items: Present and new motor investment, $5,080, or $304.80 annual interest at 6 per cent; depreciation, 5 per cent, $254; coal, 122 tons at $4.50, $549; oil, $5; fireman, $312; repairs, $25; electrical energy, $2,655.

Economy of Electric Drive for Air-Compressor Service

As an example of desirable day-load service extending through several hours at a time the accompanying data from a central station report on the electric driving of an air compressor in a large foundry plant suggest helpful methods of securing this class of business. The compressor was required to deliver 310 cu. ft. of air per minute against 100 lb. pressure, and a 50-hp engine or motor was determined upon as necessary for its operation. The service conditions required the operation of air blast five hours each forenoon at full capacity, with an afternoon operation for molding machines equivalent to filling the storage tank in the establishment three times to 1000 lb. pressure. The motor-service survey indicated that to drive the compressor with a 50-hp engine would call for an investment of $1,200, the annual cost of the service being shown in Table I.

TABLE I—STEAM OPERATION

Interest, depreciation and repairs, 15 per cent	$180
Coal, 390 tons at $4	1,560
Engineer, $1 per day (proportional)	310
Water, 750,000 gal. at 10 cents per 1000 gal	75
Oil, waste and ash removal	50
Total	$2,175

The above coal estimate is based on a consumption of 5.5 lb. per hp-hr., running seven hours per day at 50 hp, with 600 lb. of fuel per day allowed on the average for banking the boiler, including Sundays and holidays. Feed water is based on 8 lb. per pound of coal.

The investigation indicated that the operation of the compressor by an electric motor on central-station service would require an investment of about $600 for a 50-hp, three-phase induction motor and $100 for wiring. Allowing 15 per cent for interest, depreciation and repairs, the estimated total yearly cost of electrical operation is given in Table II.

TABLE II—ELECTRICAL OPERATION

Interest, depreciation and repairs	$105
Power, $141 per month, approximately	1,690
Heating, 50 tons coal at $4	200
Engineer's time, $1 per day, 150 days	150
Total	$2,145

The estimated monthly energy consumption is 6720 kw-hr., with a maximum load of 70 hp. The afternoon operation includes one-half hour's total service, equivalent to filling the storage tank three times as above mentioned. Although the above comparison shows about the same cost in each case, the central station points out that the electric drive is more advantageous, enabling the service to be handled flexibly and releasing space otherwise tied up by engine-room equipment, coal pockets and ash pits, permitting the enlargement of productive apparatus and easier rearrangement of the latter to meet new conditions. The point was also made that electric rates are fixed definitely for various loads, decreasing as the power consumption increases and from year to year becoming less as the company's business grows.

Subsequent to the above investigation the company pointed out that the installation of an automatic motor starter costing $238 and a pressure governor at $27 to operate it would enable the motor to be shut down a minimum of fifteen minutes per day, when it would otherwise operate at 25 per cent of normal load, carrying merely the friction load. It would in this way save a yearly interest charge of over $13.20, figuring the interest at 5 per cent, through the decreased energy consumption.

Illumination and Wiring

An Inexpensive Double-Reading Night Sign

In the arrow design shown in the accompanying illustrations it is only the filaments of the lamps which are lined up in the pattern to be reproduced, the frame on which their sockets are mounted being necessarily distorted slightly.

FIG. 1—ARROW SIGN AT NIGHT

The lamps, it will be noted, are held in the vertical plane so that the display appears the same from both sides. The sign is, of course, essentially a night display, but when lighted its appearance is extremely attractive viewed from either side.

Thirty-three 15-watt tungsten lamps are used in the stem and barbs, with a 60-watt unit at the point of the arrow. The receptacles employed are No. 50,715 sockets, screwed and soldered to the double frame, which is of galvanized iron. Galvanized-iron wire forms the barbs of the arrow point. The two parts of the frame are held together by the

FIG. 2—ARROW SIGN IN DAYTIME

lamp connections only, and thus serve as conductor buses in addition to forming the framework for the sign. All parts of the frame, receptacles, etc., are painted black, so that at night only the lighted lamp filaments are visible. At a distance of 100 ft. or more the lines of light appear continuous. The cost of the sign, complete, was $28.85, including lamps and labor of hanging.

The arrow sign shown is in use in front of a motion-picture theater at Arlington, Wash., but the novel idea of its construction is not of course confined to such displays alone. Mr. E. G. Robinson, manager of the Jim Creek Water, Light & Power Company, of Arlington, Wash., devised and installed the sign described.

Electric Sign of Associated Advertising Clubs

The accompanying illustration shows an electric sign erected by the O. J. Gude Company, of New York, for the annual convention of the Associated Advertising Clubs of America held recently in Baltimore, Md. The sign was 60 ft. high and 60 ft. wide and bore a reproduction of the

ELECTRIC SIGN OF ASSOCIATED ADVERTISING CLUBS

slogan of the Associated Advertising Clubs. The lettering was in white, the outline of North and South America in green, and the two circles in red. The word "Truth" remained lighted constantly, then the outline of the two continents appeared, then the outer circle of red and finally the lettering. The sign was presented to the association by Mr. O. J. Gude for use at future meetings of the Associated Advertising Clubs.

Magnetite-Lighting Costs at Dallas, Tex.

An ornamental street-lighting installation consisting of 423 4-amp direct-current series magnetite lamps supported on ornamental posts has been completed at Dallas, Tex. This new lighting system includes three installations on the main business streets, the one on Elm Street between Market and Harwood being composed of 102 lamps, while the other two installations, on Main and Commerce Streets, from Market Street to Central Avenue, together include 321 lamps. The ornamental posts are of such height as to bring the arcs 15 ft. above the street level and are staggered on each side of the street at 72-ft. intervals.

By the terms of the contract with the city and property owners on Elm Street the owners pay $2 per front foot for the installation, while the city pays for lamps on public grounds and at street intersections. The price per running foot on Elm Street was lower than that charged on Main and Commerce Streets owing to the fact that the concrete sidewalks did not extend to the curb line, which made the installation of the underground work less expensive.

In the case of Main Street and Commerce Street a charge of $2.50 per front foot was assessed against the property owners, the city paying for the street intersections and public buildings. This assessment is intended to cover the cost of the posts erected and the underground work complete. The Dallas Electric Corporation furnished all overhead wires from the generating station to the point of delivery to the underground system, as well as the switchboard panels and instruments which were needed at the power house.

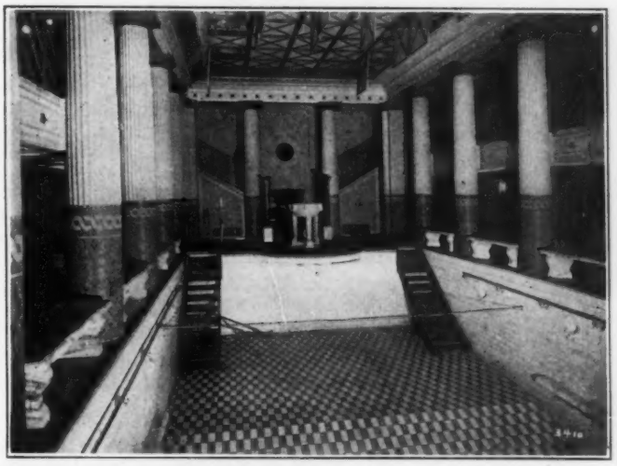
Under the terms of the contract, which extends over a period of five years, the lighting company receives $45 per lamp per year, the first year's payment being made out of the property assessment fund and the other four being made by the city. During the five-year period the central station company will also maintain the system.

Lighting of the Roman Bath, S.S. "Imperator"

Deep in the huge hulk of the great steamship *Imperator*, which last week completed her maiden voyage across the Atlantic, the passenger finds a spacious and magnificent Roman bath and swimming pool modeled along the lines of the famous natatorium of the London Automobile Club, an illustrated description of which was given in these columns Aug. 19, 1911. The bath aboard the great ship evinces a lavish disregard for the limitations of space which appears extravagant indeed to the traveler accustomed to the ordinary steamer stateroom accommodations. This main Roman salon, elaborately finished in bronze and marble, measures 65 ft. long and 41 ft. wide, extending through two decks. Surrounded by massive Pompeiian pillars and marble benches is the pool itself, 21 ft. by 39 ft. in plan, and 7 ft. deep.

An ingenious adaptation of "skylight lighting" gives the room, actually deep in the bowels of the ship, the appearance of an open-deck compartment. The ceiling is divided into seventy-five panels of diffusing glass, behind each of which there is mounted a ring-conduit fixture supporting four 40-watt tungsten lamps. These units project a uniform, diffused illumination upon the blue waters of the pool below, filling the entire apartment with an unsually agreeable quality of light.

At the level of the intermediate deck a visitors' gallery encircles the room, behind pillars. The passageway beneath this gallery affords access to the various shower, Turkish, Russian, hydropathic, electric-light and electrical bath com-



SWIMMING POOL

partments which surround the main salon. These passsageways are lighted by sunken indirect domes set into the low ceiling. For the visitors' balcony wall-bracket fixtures equipped with candle lamps furnish sufficient illumination.

Nearly 10,000 incandescent lamps are employed for lighting the decks and cabins of the *Imperator*. The turbine-driven generating equipment aggregates 200 kw. in addition

to which there is an emergency set driven by an internal-combustion engine and located on the upper deck, which is held in reserve to furnish energy for corridor lighting and wireless signaling in case of the flooding of the main engine room.

Unusual Uses of Electric Signs by Churches

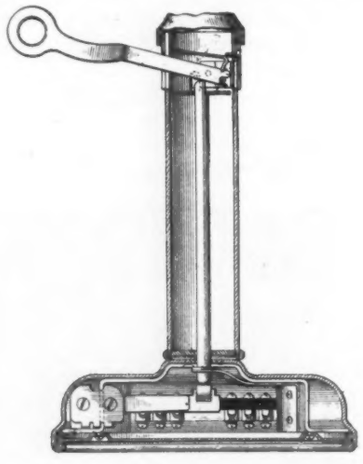
Churches are using electric-sign advertising to an increasing extent to show the way to grace and for other purposes. Two 500-watt tungsten lamps have been attached to the spire of the Immanuel Baptist Church on Michigan Avenue, Chicago, at a height of about 250 ft. It is planned to have the lamps lighted at dusk and burn until dawn. Electricity for the entire church is supplied by the Commonwealth Edison Company of Chicago. The lamps have been installed to remind the public of the presence of a church and will eventually, it is hoped, serve to increase the attendance.

Electric lamps on a prominent Baptist church were installed for a somewhat different purpose. A cluster of five lamps, arranged to flash every two minutes, was intended to show the birth rate in China. By this method it was hoped to impress those attending the Northern Baptist Convention with the need of a larger misssionary fund.

Recent Telephone Patents

Desk Instrument

While the desk telephone has long since reached a standard form, its internal design varies widely. In a desk stand patented by Mr. N. Pederon, of Chicago, the switch springs are located in the base with the induction coil. One spring of the set carries a rubber roller against which a vertical spindle acts to shift the contacts. The spindle in turn is



TELEPHONE DESK INSTRUMENT

driven by the hook lever which is removable and is latched in position by a spring. A section of the stand is shown in the illustration herewith. The patent has been assigned to the Cracroft-Leich Electric Company.

System for Use on Moving Trains

Mr. H. Von Kramer, of Birmingham, England, has invented a system for signaling from moving trains. His system includes both telephone and telegraph signaling. A loop circuit is arranged along the track and look circuits are wound around the cars to lie in a plane parallel to the track. Transmission is effected by induction between the loops. Separate receiving and transmitting loops are arranged so that conversation or signals both ways may be had simultaneously.

Antiseptic Device

A rather elaborate antiseptic device is described in a patent granted to Mr. E. A. Dieterich, of New York City. A containing box is secured to the transmitter front by the clamping action of the mouthpiece. Two drums are provided so that a strip of fibrous material may be drawn across the mouthpiece from one to the other. The storage drum is hollow and loaded with perfume which reaches the inside surface of the strip. The outer surface is hand-treated with disinfectant from a revolving brush the spindle of which is driven by the storage drum.

Party-Line System

The feature of the party-line system patented by Mr. B. C. Groh, of Trenton, and assigned to the Stromberg-Carlson Telephone Manufacturing Company lies in the method of short-circuiting simultaneously all receivers on the line. If the operator wants the line while it is in use by two or more of the stations connected thereto, she may apply energy from the battery. Relays then operate at each station to cut out the receivers. The transmitters are not cut out of the circuit, and hence the operator may determine which party wishes to continue to use the telephone.

Letter to the Editors

The Myriawatt

To the Editors of the Electrical World:

Sirs:—Those interested in one way or the other in the attempt being made, largely through the instrumentality of the American Institute of Electrical Engineers, to erect a trade rating to the status of a scientific unit will, it is hoped, have accorded to them at some future time the privilege of reading in the *Transactions* of the Institute an account of the discussion on the "myriawatt" which formed part of the program of the mid-winter meeting of that body in February. What follows has been held awaiting such publication, and is now presented while the matter to which it relates, and which is subject to final action at any time, is yet more or less within the memory of those who read the announcement of the proposed "new unit" about a year ago.

This discussion recalled the traditional attitude of the party orator toward a delicate political situation, which he evades by occupying his time on the floor with eloquent tributes to the constitution. As a glorification of the metric system the discussion was a success, but none would learn from the remarks of many of the speakers that the actual subject under consideration was a boiler rating. When the proposed rating, euphemistically styled "a new power unit," was specifically referred to, it was with little reference to its assumed merits, but rather to its character as a cunning expedient whereby recalcitrant "mechanicals" were to be enmeshed in the metric net. That in a public discussion plans and specifications should be revealed of a trap set for brother engineers is certainly ingenuous, and seemingly implies a sorry opinion of the intelligence of those to be overcome.

The discussion might, however, have been much enlivened if an analysis had been offered at the meeting showing the absolute lack of any scientific basis for the proposed "new power unit"; by pointing out the absurdity of endeavoring to perpetuate, without possibility of further revision, a boiler power rating based upon an engine heat consumption per horse-power-hour corresponding to the thermal units in 34.5 lb. of steam evaporated from and at 212 deg. Fahr. —this at a time when a lengthy search would have to be made to find an engine of such inferior efficiency, in a day when steam prime movers are sold on a guarantee, on the above basis, of less than 10 lb. of water, and when a claim is made for a figure below 8 lb. Further incitement to

debate might have been offered by pointing out that the decimal relation upon which the myriawatt rests is entirely fortuitous in any scientific, or even schoolboy, sense—that the relation would actually be 20 or 30 instead of 10 if the horse-power rating of boilers more nearly corresponded with present-day engine efficiencies; by dragging out of the woodpile for closer inspection the fact that the fundamental and sole base of the proposed "unit," the quantity 33,479, or approximately ten times the value of the kilowatt-hour in pound-Fahrenheit thermal units (3415), is merely the product of 34.5 (pounds of water) by 970.4 (thermal units to evaporate 1 lb. of water from and at 212 deg. Fahr.); furthermore, by showing that any rating connecting a boiler with an engine which is based upon a standard evaporation is a scientific absurdity, for the reasons, among others, that there is no physical relation between the boiler evaporation and the specific steam consumption of an engine, and that the rate of evaporation which fixes the supply of energy to the engine depends upon many independent boiler variables, such as heating surface, ratio of grate to heating surface, type of boiler, kind and quality of coal, kind of draft, method of firing, etc. One sufficiently brave might even have been tempted to point out that scientifically and practically the "new unit" would have little more status than a hydraulic power unit based, in connection with a "standard" head, upon the size of a water-power dam.

But it may be thought by some that if the proposed "unit" should serve a useful practical purpose the matter of its hybrid character, its unscientific basis, could well be overlooked. This would be a regrettable position for a member of the American Institute of Electrical Engineers to take on a proposition committing that body to an action so astonishingly at variance with its past enviable record in relation to units; though, of course, commercially justifiable if the proposition were one put forward instead by a boiler manufacturers' association to meet an unsatisfactory trade boiler-rating situation.

The myriawatt, however, has not even this excuse, either from the standpoint of the engineer or the manufacturer; for, as previously pointed out, it does not in a single particular differ from the existing trade horse-power boiler rating except in name and in an increase of about 2 per cent in value. The grave practical fault of a boiler rating based upon a standard evaporation—a fault which has prevented the use of such a rating in Europe, has led to its entire neglect in this country by the marine engineering profession and by boiler designers, and to its little use by technically educated engineers in general—is that it does not even give a close clew to the size of a boiler for a specific service. For example, the boilers at the Detroit Delray generating station, which would be rated in the proposed nomenclature at 2365 myriawatts each, are said each to supply steam for the generation of 7500 kw. Again, a boiler of 100 myriawatts actual on the basis of natural draft and anthracite coal for fuel would, say, increase to 125 myriawatts actual with good soft coal, to 150 myriawatts actual with high chimney draft, and to 200, 300 or more myriawatts actual with forced draft.

Although a matter of relatively little moment, the name of the "new power unit" is also not free from objection, both as relates to the prefix "myria" and to the status of the "ten-thousand" metric multiple. While it is true that the word from which it is derived means, in Greek, ten thousand, in English it has never had that definite meaning, but, as every one knows, has the indefinite significance of "a great number." Even as employed in the single instance in scientific nomenclature aside from the metric system, the Greek meaning is ignored; for the genus "myriapod" comprises those crawling things having, not ten thousand, but numerous legs, such as the centipede. Even the French, with their racial characteristic to follow an idea to its utmost logical consequences, have halted at the "myria" metric nomenclature, which has never received practical adoption in France or elsewhere. The reason for this is perhaps that it was unconsciously felt to be illogical to use a unit that would compel one to think in terms of, say, four ten-thousands instead of forty thousand.

The sad part of this attempt to foist on the engineering public as a "power unit" an existing trade rating having originally no excuse for being, which in value has become obsolete, and which in its proposed form would not admit of being brought up to date, is the ill effect on the prestige of the American Institute of Electrical Engineers through its connection with the measure. In the past that body has taken the lead among the professional bodies of the world in advancing and securing the adoption of scientific units. Those who in Philadelphia in 1884 brought forward the watt as the unit of power were the same who almost simultaneously organized the Institute, which body subsequently did most in securing the international adoption of the watt and of its multiple, the kilowatt. It secured the international adoption in 1893 at Chicago of the henry, was the largest factor in fixing the practical use of the c. g. s. magnetic units, and gave to these the names by which one or more are now widely known. In this and in other similar work the Institute previously closely adhered to scientific method—to the method of Gauss and the other great minds that have laid down the principles of absolute physical relation upon which scientific standardization should be based in order that such standardization shall aid rather than handicap the future progress of science, pure or applied. From this record to the countenance recently given to the "myriawatt" is an immense departure, which is rendered more astonishing by the hint—indeed, public admission—that the Institute committed itself to the "new power unit," so far as it has done so, as a measure of scientific practical politics in order to advance the cause of the metric system. It is fortunate for the metric system that this stands as an isolated event in its history.

With absolutely no hope of international adoption; with little hope of securing scientific or other recognition in this country of what is simply in disguised form an existing trade rating, obsolete in value, persistently ignored by great bodies of engineers, and to which there have been given merely a new name and form that render impossible future revision of value; a proposition that met with derision from the European engineering press and, following its presentation before the recent annual meeting of the International Electrotechnical Commission, had not accorded to it even the courtesy of mention in the official report of the meeting—these and other considerations surely present a situation which seems to call for some serious official notice on the part of the American Institute of Electrical Engineers. The probable natural death of the "new power unit" would not absolve the Institute from such responsibility as it actually assumed in giving it life, for the evil effect of its indorsement will linger beyond the grave. The case appears to call for a definite official announcement by its governing body, as guardian of the prestige of the Institute, of the nature and extent of this responsibility.

In conclusion, it may be pointed out that as a result of attempts made to commit similarly another American engineering body to measures which would have imposed professional obligations on the entire membership, the sister society so amended its constitution as not only to guard against preliminary official consideration of propositions of which the myriawatt may be cited as an extreme example but to provide means whereby, upon favorable report from the governing body, such propositions may be submitted to the vote of the membership at large. A similar amendment to the A. I. E. E. constitution could do no harm and would most effectually remove future menace of recognition of such an astonishing "unit of power" as that made the subject of this letter.

Charlottesville, Va. W. D. WEAVER.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Connection Board for Metering Power

The accompanying illustration shows an improved arrangement for reading the current in three lines using only one ammeter, as well as for reading three-phase watts with only one single-phase wattmeter. The board is "fool-

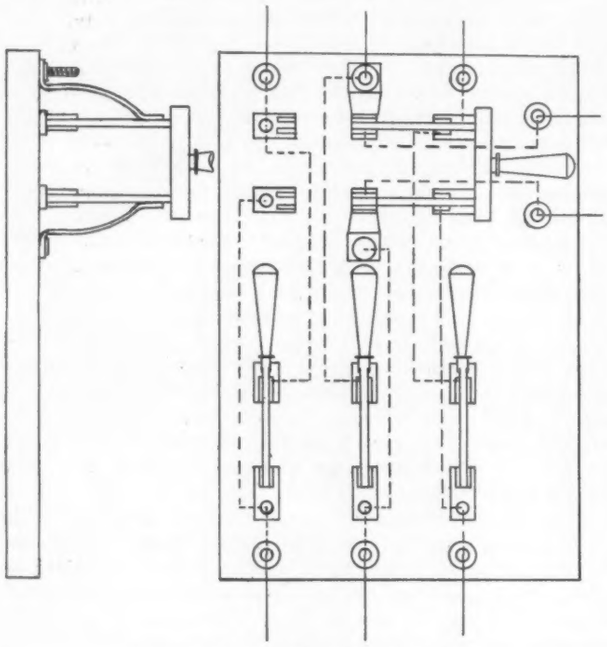


DIAGRAM OF CONNECTION BOARD

proof" when properly wired up, and it is difficult to make an error in connections.

No interlocking mechanical parts are necessary. The number of special pieces required is reduced to a pair of raised clips which convert the double-pole switch into a triple-throw connection. The three single-pole switches serve as line switches and as ammeter-short-circuiting switches.

If the three lines coming from the source of power are connected to the three terminals at the top of the board and the load is connected to the three terminals at the bottom, the circuit is closed by using the three single-pole switches. The current in the left line is read by connecting the ammeter to the two terminals at the side of the board and closing the main switch to the left. Opening the left single-pole switch allows the current in this line to pass through the meter. Next, by closing the single-pole switch, moving the main switch to a position vertical to the board so that it makes contact with the raised clips, and opening the middle single-pole switch, the current in the middle line can be read. For the current in the third line, close the last single-pole switch, move the main switch to the right and open the right-hand switch.

To measure power with a single-phase wattmeter, the current coil of the instrument is connected in series with the ammeter, and one end of the potential circuit is led to the middle terminal at the top of the board. The other potential terminal of the wattmeter is then led to the left-hand or right-hand line corresponding to the one in which the current coil is connected. The sum of the two readings gives the total power being transmitted. No wattmeter reading is, of course, taken with the current coil in the middle line. When the power-factor is less than 50 per cent the smaller wattmeter reading will be negative and should be subtracted from the larger.

The connections indicated by the dotted lines are made on the back of the board. Equipped with 60-amp, 125-volt switches and suitable terminal posts for the external connections, the board measures 12 in. by 20 in.

Two of these boards have been in use for two years in a very busy laboratory and have given entire satisfaction.

The Attendantless Rotary-Converter Substation at Detroit

The Rowena Street 500-kw rotary-converter substation of the Edison Illuminating Company of Detroit is operated with no attendant in the substation itself, all the operations of starting, stopping, voltage control and load adjustment being performed from Station I, a mile away.

The automatic substation feeds into the Edison three-wire network in a residential section which has recently enjoyed unusual growth. For the latter reason the Edison company was faced with the alternatives of installing excessive feeder copper or putting in a new substation to hold up the voltage on this part of the system. No control wires connect the automatic station with the operating point, the only conductors extending between the two stations being the main 4400-volt triple-conductor primary cable carrying the main energy from Station I to the converter equipment. Automatic devices installed also protect the equipment in case of disturbances on the line or accidents within the substation itself.

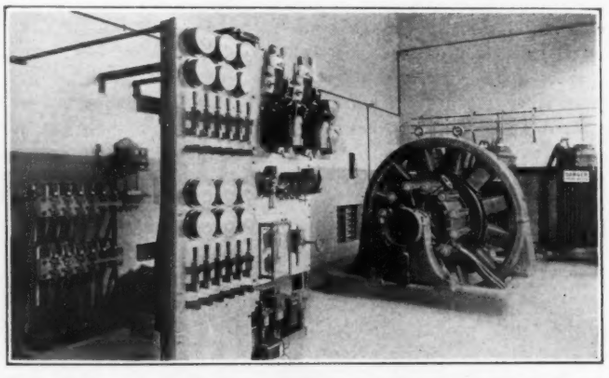


FIG. 1—INTERIOR VIEW OF AUTOMATIC ATTENDANTLESS SUBSTATION

An account of the installation and operation of this automatic substation was given by Mr. H. R. Summerhayes before the convention of the American Institute of Electrical Engineers at Cooperstown, N. Y., June 23. Referring to the diagram of the circuits, Fig. 5, there is installed in the main station a 4400-volt, 60-cycle, three-phase starting compensator with one-third, two-thirds and

full voltage taps and an induction regulator with 20 per cent voltage range. Of the four oil switches, No. 1 is a magnetizing switch, Nos. 2 and 3 connect with the compensator, and No. 4 is a running switch.

The converter at the substation is a six-phase, twelve-pole, 250-300-volt direct-current machine running at 600 r.p.m. A bank of three 175-kva, 4400/205-volt oil-cooled transformers supply energy to its alternating-current side. The substation building is without windows to prevent noise being heard in the street, while light and ventilation are obtained through roof openings.

OPERATION AND STARTING

To start up the converter, the operator at Substation I proceeds as follows:

First, the induction regulator is set at maximum lowering position.

Second, the magnetizing switch is closed.

Third, the one-third-tap switch is closed, throwing one-third voltage on the line leading to the Rowena Street substation. The converter starts on this tap and reaches synchronism in twenty or thirty seconds. Within 5 per cent of synchronism, the governor closes the control circuit of the field contactors and the four-pole contactor operates

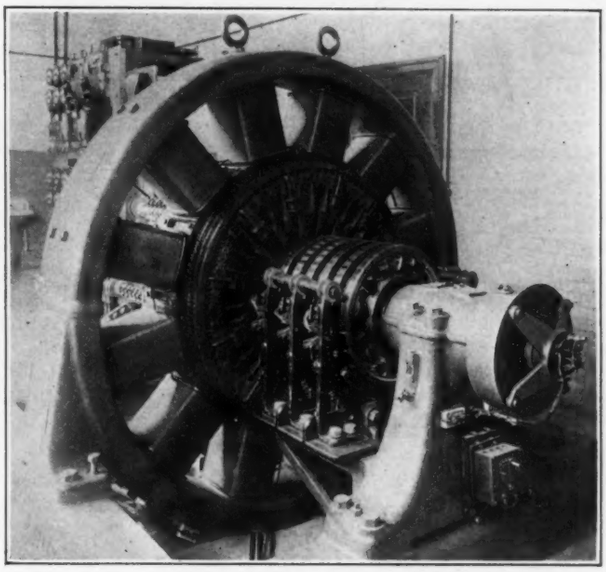


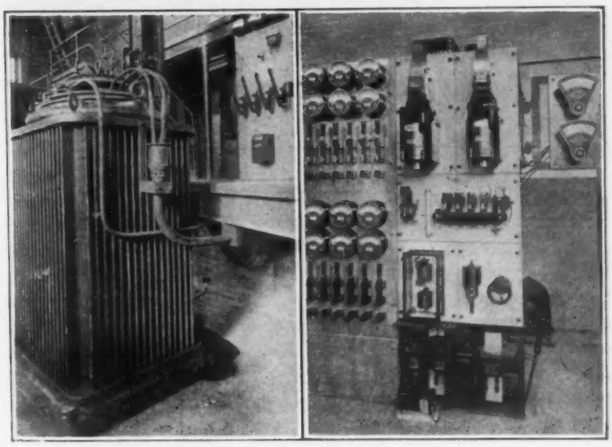
FIG. 2—SLIP-RING END OF CONVERTER WITH AUXILIARY DEVICES

immediately. exciting the rotary-converter field from the bus so as to give it the correct polarity, but with a considerable resistance in series with the field. As soon as this weak field is thrown on, the rotary converter pulls into synchronism with the proper polarity but at one-third voltage. This operation is made evident to the operator at I Street by watching his alternating-current ammeter, on which the current decreases from the initial starting current to about one-half and suddenly increases as the field is automatically applied, then settles to a low and steady value as the converter falls into synchronism.

Fourth, just after the automatic application of the field, the operator opens the one-third-tap switch and closes the two-thirds-tap switch.

Fifth, the operator then opens the two-thirds-tap switch and closes the running switch. After the closing of this switch the converter is in synchronism, but is operating at a low direct-current voltage on acccount of the position of the induction regulator and operating with a very weak field. On account of the weak field, the power-factor at this time will be lagging.

Sixth, within a few seconds, the second field contactor automatically operates, cutting out sufficient field rheostat so as to give the rotary full normal field current. The control circuit of this contactor was closed by the governor at the same time as the other contactor, but its operation was delayed by a time-limit relay. The operation of this contactor is immediately evident to the operator at Station I by the increase in current on the alternating-current am-



FIGS. 3 AND 4—REGULATOR, STARTING SWITCHES AND CONTROL BOARD FOR ROTARY CONVERTER

meter and the changing of the power-factor from lagging to leading.

Seventh, at this point the converter is running in synchronism with full field and correct polarity and is all ready to be connected to the direct-current buses, excepting that its voltage is low, owing to the position of the induction regulator. The operator now brings up the voltage by the induction regulator, and at the moment the voltage across the brushes of the converter exceeds by a very small percentage the voltage on the buses the contact-making voltmeter operates. This device is differentially wound, one coil being connected to the buses and the other to the brushes of the converter. The bus voltage may vary at different times of day from 250 to 300, but whatever voltage is across the buses, this differential device acts only when the synchronous converter voltage exceeds the bus voltage by a small percentage. This device makes a cir-

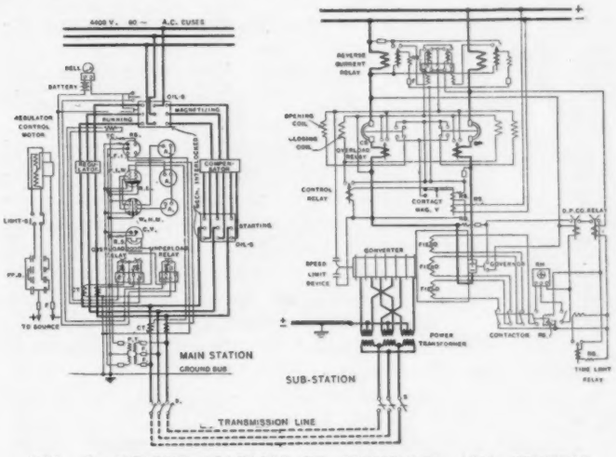


FIG. 5—WIRING DIAGRAM OF CONVERTER AND CONTROL APPARATUS

cuit through the control relay which operates the closing coils of the two main circuit-breakers and connects the synchronous converter to the busbars. This action is so accurate that the rotary may be made to take any percentage of load that is required. Ordinarily it is so adjusted that when the circuit-breakers close the converter takes about one-tenth load.

Control and Automatic Protection

The voltage at points on the Edison three-wire system in the neighborhood of the Rowena Street station is observed at Station I by means of the presssure wires ordinarily used on these Edison systems, and the amount of load taken by the converter at Rowena Street is changed by the operator to meet the voltage conditions on the system. The change in load is effected by manipulating the induction regulator.

The amount of load at any time is indicated by the alternating-current ammeters in connection with the indicating wattmeter and the power-factor meter.

To stop the synchronous converter, the running switch at Substation I is opened. This disconnects the alternating-current supply and leaves the synchronous converter running as a direct-current motor. The reverse-current relays are set so that they will operate on the current which the converter takes as a direct-current motor and their operation opens the main circuit-breakers and disconnects the converter from the direct-current busbars. As the converter slows down, the governor resumes its starting position and the field contactors open so that everything is ready for a new start.

Protection

In case of a short-circuit on the alternating-current system the direct current feeding back from the latter systems through the synchronous converter operates the reverse-current relays and opens the solenoid circuit-breakers.

In case of a local alternating-current short-circuit the alternating current feeding into the short-circuit operates the overload relay and opens the main switch at Station I, disconnecting the converter from the line. If both reverse-current relays should fail, the speed-limiting device and the overload coil are both available to open the circuit-breakers.

The field of the converter is protected by a double-pole overload relay. The shut-down of the converter from any cause is indicated by the underload relay at Substation I. The bearings are of the ring oiling type, so that very little trouble may be expected.

In addition to the governor for closing the field circuit, the synchronous converter is equipped with the usual centrifugal speed-limit device.

The illuminating company expects to extend this remote-control system to other substations. The fire risk is practically nil, except for the chance of the windings of the machine taking fire from an accidental burnout. This may be minimized by automatic extinguishers.

Automatic rotary-converter substations of this type, said Mr. Summerhayes in conclusion, enable the Edison three-wire system to be extended as a means of economical distribution over territories much greater than now possible. With the labor expenses limited to daily inspections, it becomes possible to operate substations where previously the density of the load would not have warranted such installations. By using smaller substations set more closely together it will also be possible to reduce the investment in feeder copper.

An Electromagnetic Window Display

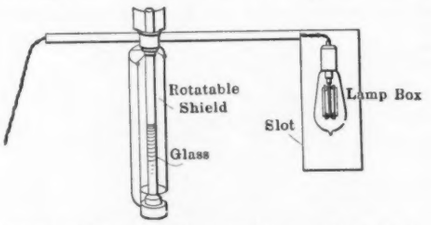
Characteristic of many of the window displays made by branch offices of the National Cash Register Company an interesting electrically operated advertising scheme has been attracting considerable attention recently at the Chicago office of the company on East Randolph Street. Although there is no outward evidence of electrical application, the whole operating mechanism, concealed in the base of apparatus, is electrically driven.

The apparatus consists of a tank about 8 ft. long and 3 ft. wide, filled with water and imitation rocks, so as to represent a harbor on some rocky coast. A miniature steel ship bearing the name *Good System* skilfully plies its way between the rocks which menace its course, although other boats lie wrecked and stranded on these rocks, which represent business dangers.

Beneath the tank containing the water is a circular track on which runs a small truck carrying a double-pole electromagnet. The magnet receives its energy from the rails, and the ship, which has a soft iron keel, is of course forced to follow the magnet throughout its route. The truck is pulled along the track by a chain which engages with a sprocket on the shaft of an electric motor. The apparatus operates on 110-volt direct current.

Safety Water-Column Shield and Lamp Box

Safety engineers are recommending the use of rotatable shields on the water-column glasses of boilers, the arrangement being such that the metal protector can be swung around between the workman and the glass when changing



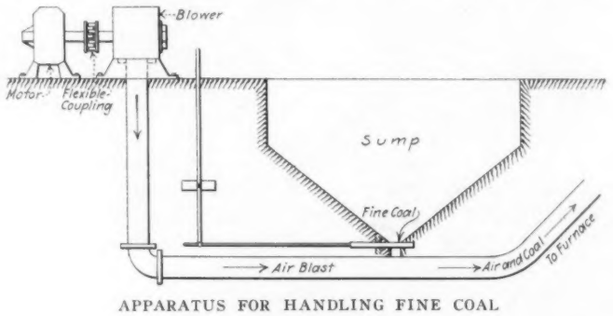
SAFETY WATER COLUMN SHIELD AND LAMP BOX

glasses. At other times the shield is moved to a position, as shown in the accompanying sketch, where it serves as a reflector for the light coming from the slotted lamp box, thus aiding the eye in judging the height of the water column. When installing these glasses the workman is cautioned to see that the glass fits loosely and that the glands are in perfect alignment, so that free expansion may take place without danger of breakage.

Saving the Fine Coal

Can you describe some method of reducing the labor connected with reshoveling fine coal which has fallen unconsumed through furnace grates? M. R. T.

One of the ingenious devices mentioned in the report of the N. E. L. A. committee on prime movers at the Chicago convention was an arrangement for saving fine coal and getting it upon the grate in a fashion that prohibited it from again falling through the stokers. The company using this



APPARATUS FOR HANDLING FINE COAL

device has installed a motor-driven blower so that it draws air from a sump in the fine-coal pit and discharges it into the furnace above the fire. When it is desired to clean the fine-coal pit the coal is scraped into the sump and the blower started. In a short time all of the fine coal is thus blown into the furnace and the greater part of it is burned before falling to the grate.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Leblanc Exciter.—P. EHRMANN.—The first part of an illustrated discussion of the principles of operation of the Leblanc "exciter"—that is, an auxiliary polyphase commutator machine connected to the slip-rings of the induction motor to be regulated. Its action with respect to the induction motor is analogous to that of the direct-current exciter of a synchronous motor or alternator. It furnishes to the rotor of the induction motor the magnetizing ampere-turns which are necessary for excitation. It permits one to increase the power-factor to unity and even to overexcite the induction motor. The exciter also permits regulation of the speed of the induction motor. This machine has found only a limited number of applications, but it possesses desirable characteristic properties, is small in size and simple in operation.—*La Lumière Elec.*, June 7, 1913.

Induction Motor Control.—A note on a recent British patent (No. 8070, 1912) of the Siemens-Schuckert Company. To adjust the speed by varying the frequency and pressure of the power current, a self-excited series-connected commutator generator is joined to a transformer through a choking coil, saturated so that as the frequency of the generator is reduced by altering the ratio of the stator and rotor pressures the effective magnetic characteristic simultaneously drops and stable pressures are produced approximately proportional to the frequency. A transformer with adjustable secondary in parallel with the stator may also be added to the mains.—London *Elec. Eng'ing*, June 5, 1913.

Standardization Rules.—An article giving in tables a comparison of the standardization rules of the British Electrical and Allied Manufacturers' Association and the corresponding rules of the American Institute of Electrical Engineers and those of the German Association of Electrical Engineers. The comparison is chiefly given in a convenient form in tables.—London *Elec. Review*, May 30, 1913.

Lamps and Lighting

Modern Electric Sources of Light.—BERTHOLD MONASCH.—A report of recent developments in arc lamps, incandescent lamps and vacuum tubes, to be presented at the next convention of the German Association of Electrical Engineers. The arc-lamp industry has now two competitors, namely, the tungsten lamp in sizes up to 1000 cp and compressed gas in larger units. Success has been obtained in the arc-lamp industry in the construction of flame-arc lamps with special electrodes with a life of from 70 to 100 hours. Schaeffer has developed a three-phase arc lamp and Wolffke the white-light cadmium vapor lamp; it is not known whether these two lamps are in commercial operation. The mercury-vapor lamp with quartz globe has been developed for 500-volt circuits. In the incandescent-lamp industry the carbon lamp is being replaced more and more by the tungsten lamp. The tungsten lamp has been improved in two entirely different ways, one of which has been the invention of ductile tungsten while in the other the old compression method is employed but certain secret additions are made to the tungsten so as to yield a ductile and strong filament. The two methods are said to be in strong competition with each other at present. Among vapor-tube lamps the Moore lamp is finding more favor for interior lighting and the lighting of buildings. Claude has obtained with his neon tubes an even better efficiency than is obtainable with the Moore tubes.—*Elek. Zeit.*, June 5, 1913.

Moore Vacuum Lamp.—The operation of three vacuum tubes by three-phase currents is of importance as it avoids the fluctuations of light during one period. It has been found that if the three tubes are connected to the three secondaries of a transformer in such a way that a single phase on the primary side can be disconnected the corresponding vacuum tube in the secondary circuit is extinguished. This has the advantage that the three tube sections can be placed in different rooms and can be connected and disconnected without affecting the other sections, so that any one or two of different rooms can be illuminated without regard to the others. While thus far the maximum length of tube is 55 m, installations can be made in which the length of the tube equals the product of 55 m and the number of phases, so that it is 165 m with three-phase currents. Another recent improvement is

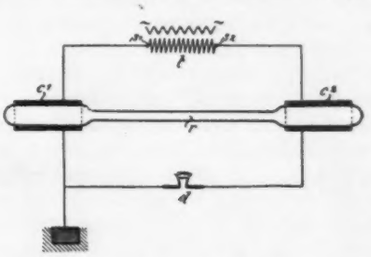


FIG. 1—IMPROVEMENT IN MOORE VACUUM LAMP

illustrated in Fig. 1, where l_r is the tube and c^1 and c^3 are the two electrodes which are supplied with energy from the high-tension transformer t. The novel feature is the provision of a second circuit containing a spark-gap d (E being the earth). This spark-gap is also connected to the two electrodes. The transformer charges periodically the two electrodes c^1 and c^3, which are then discharged partly through the tube and partly through the spark gap d. This permits the production of different spectral effects. For instance, lines in a certain part of the spectrum can be made lighter so that the color of the light may be changed. When gas mixtures are used certain spectral lines of one gas may be strengthened and those of the other may be weakened.—*Zeit. f. Beleucht.*, May 30, 1913.

Generation, Transmission and Distribution

Corona Losses.—WEIDIG AND JÄNSCH.—The first part of a long report to be presented at the next general convention of the German Association of Electrical Engineers. The authors first discuss the critical minimum voltage at which the formation of corona around the wire takes place and then discuss the corona lossses with a voltage above the critical minimum value. They finally give an account of an experimental investigation carried out in the Institute of Technology of Dresden. The paper is to be concluded.—*Elek. Zeit.*, June 5, 1913.

Direct-Current Series System.—J. S. HIGHFIELD.—An illustrated paper read at the recent joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Électriciens in Paris. The

author compares the direct-current series transmission system of Thury with the more usual three-phase system, dealing with questions of cost, earthing and design as affecting generating and substations from this point of view.—London *Electrician*, June 6, 1913.

Bordeaux.—J. Reyval.—A continuation of the long illustrated serial on the electricity supply of Bordeaux. The substation at Bordeaux-Centre and the Temple steam plant are described and details are given of the distribution networks within the city of Bordeaux.—*La Lumière Elec.*, May 31 and June 7, 1913.

Traction

Multiple-Unit System.—An illustrated description of the new multiple-unit rolling stock of the Ouest-État railway in Paris.—London *Electrician*, June 6, 1913.

Installations, Systems and Appliances

Central-Station Statistics of Denmark.—R. J. Jensen.—A review of the latest central-station statistics of Denmark compiled by Paul Vinding. In 1911 there were built fifty-seven new stations, of which ten are in cities and forty-seven in the country. The total number of stations was 75 in 1906 (7000 hp), 236 in 1910 (24,650 hp) and 293 in 1911 (31,100 hp). This does not include the stations in Copenhagen and Frederiksburg, with a rating of 33,240 hp. All citizens in Denmark with more than 5000 inhabitants have electric stations.—*Elek. Zeit.*, May 29, 1913.

Horn-Gap.—A. W. Burke.—The two principal defects of the horn-gap are the slowness of the arc in rising on the horns and the necesssity of a close setting of the air-gap. The author gives a number of illustrated descriptions of various designs of a horn-gap in which attempts are made to overcome these defects.—*Elec. Journal*, June, 1913.

Safety of Electric Installations.—G. Dettmar.—A conclusion of his long statistical article on the various applications of electricity in Germany with reference to accidents and fires. The figures show that the safety of electric installations has steadily increased and is still increasing. It is further shown that the number of accidents or fires which have been avoided by the use of electricity is very much larger than the number of accidents or fires which have been caused by electricity.—*Elek. Zeit.*, May 22, 1913.

Large Distribution Networks in France.—E. de Longueval.—A statistical article illustrated by maps, giving a historical sketch of the evolution of large electric distribution networks in France.—*La Lumière Elec.*, May 10, 1913.

French Electrical Industry.—The first part of a long statistical article on the development of the electrical industries of France.—London *Elec. Review*, May 16, 1913.

Flatirons.—G. H. Elliott.—An illustrated article giving details on construction and installations of electric laundry irons.—London *Elec. Review*, May 16, 1913.

Electrophysics and Magnetism

Efficiency of the Electromagnet.—L. Schüler.—A conclusion of his illustrated mathematical paper in which the author shows how to predetermine the variation of the current in time and the motion of the armature during its attraction by an electromagnet. From this the electrical work and the mechanical work, hence the efficiency, can be found. Numerical examples are given.—*Elek. Zeit.*, June 5, 1913.

Positive Rays.—Sir J. J. Thomson.—An address before the Royal Institute of Great Britain on some further applications of the methods of positive rays. The first application described is to detect the rarer gases in the atmosphere. The second application is the discovery and investigation of a new substance. He has found a gas having apparently an atomic weight of 3. This must be either a new element or a polymeric modification of hydrogen represented by H_3. —*Popular Science Monthly*, June, 1913.

Molecular Structure of Insulators.—H. M. Dowsett.—The author bases his explanations upon Sir J. J. Thomson's electronic theory of the structure of the atom. Concerning the state of the atoms that gives certain substances their property of insulation, or, in other words, of resisting the electronic transfer between their atoms, he says that, except in the case of certain inactive gases which are supposed to have no free electrons, in all insulating substances the atoms are either (a) very closely crowded, so that their electrons are incapable of movement or (b) are spaced so far apart that their mutual action, tending to free each other's electrons, is too weak to take effect. Of the (a) order is the element sulphur, which, with its atoms closely packed together, has a resistivity 2×10^{21} times that of copper, while the resistivity of selenium measured in the dark is 2×10^{22} times that of copper. Of the (b) order are the vapors of all conducting metals and gases in which the molecules have become so diffused as to cause a state of insulation. Again, conductivity in liquids and gases involves a breaking up of the molecular state before it can take place, owing to the fact that the electrons being relied upon to hold the atoms of a molecule together are less free in this state and tend to a state of insulation. In regard to the influence of the molecular grouping of the substances, the amorphous or structureless state, in which all the molecules are independent of one another, is that which gives the best insulating properties compared with that of definite structure or crystalline state, although there are at the same time many good insulators such as mica and quartz that have a definite structure. When sulphur is changed from its amorphous to a crystalline state its insulation falls. Selenium unexposed to light is an insulator, but on being exposed to light receives a structure and its resistance drops very considerably. Glass is a good example of high insulation obtained by a structureless state. Blown glass shows a marked superiority in insulation over molded, rolled or spun glass of the same composition, owing to the straining apart of the molecules in the process of blowing. The diamond offers an interesting exception to this rule as regards structure. Although of octahedral crystalline structure, it is a good insulator, and conversely, when converted by the heat of the electric arc to the state of a structureless solid, it becomes a good conductor. The explanation of this is that the diamond having been formed by nature under a process of intense heat and pressure, the great heat has deprived the carbon of its free electrons, and the atoms, having been forced by great pressure into very intimate contact, are unable until released again by the application of intense heat to allow the normal number of free electrons to return to their respective orbits and so give a conducting property to the substance.—From *Wireless World* (abstracted in London *Electrician*, June 6, 1913).

Polarized Roentgen Radiation.—J. Crosby Chapman.—All the experimental evidence obtained within the last few years indicates the fundamental identity of X-rays and light. This evidence includes experiments on the properties of the scattered, fluorescent and corpuscular radiations, as well as on the polarization, interference, reflection and velocity of X-rays. These seem to establish the theory that X-rays are merely light waves of exceptionally short wave-length. Previous to the recent experiments on interference one of the most significant properties which Roentgen rays had been shown to possess was that of polarization. Barkla showed that it was possible to produce a secondary beam of X-rays which shows fairly complete polarization. Up to the present all experiments on the rotation of the plane of polarization have been made using light of a wave-length of the order of that found in the visible spectrum. The results indicate that the magnitude of the rotation in quartz and other active substances varies inversely as some power of the wave-length. This power over a considerable portion of the spectrum examined is the square, but it does not hold over a wider range. On the assumption that Roentgen radiation is merely light of

exceptionally short wave-length, it seemed possible that a great rotation of the plane of polarization of X-rays might be obtained under suitable conditions. The object of the author's research was to test directly whether anything corresponding to a rotation of the plane of polarization could be obtained with X-rays. Three substances—iron in a magnetized state, quartz and active sugar solution—were examined to see whether they have any power of rotating the plane of polarization of X-rays. The X-rays themselves are assumed to be essentially similar to light but of exceptionally short wave-length. In all cases a negative result was obtained, indicating the limited range of wave-length over which the usual rotation formulas hold. Iron absorbs a polarized beam of X-rays to the same extent whether magnetized or unmagnetized. The absorption of a plane-polarized beam of X-rays by tourmaline cut parallel to the optic axis is independent of the orientation of its axis with reference to the plane of polarization of the X-rays.—*Philos. Mag.*, June, 1913.

Units, Measurements, and Instruments

Radiometry.—W. W. COBLENTZ.—A long paper on the latest attainments in the construction of instruments used in measuring spectral radiation. The paper deals especially with four instruments for measuring radiant energy, namely, the radiomicrometer, the linear thermopile, the Nichols radiometer, and the bolometer with its axiliary galvanometer. As a result of this historical inquiry and by experiment it is shown that the radiomicrometer is capable of great improvement by reducing its weight, by lengthening its period and by placing it in a vacuum. On account of para-magnetism and dia-magnetism the sensitiveness of the short period radiomicrometer is limited to perhaps only one-half that of the best vacuum bolometers described. The instrument is free from magnetic disturbances, which permits the use of a longer period, and by placing it in a vacuum of 0.1 mm or less pressure its sensitivity is comparable with that of a good bolometer. By properly shielding it from sudden changes in temperature and by using a long period the sensitivity of this instrument should excel all the other types. The Rubens thermopile is only about one-half as sensitive as a bolometer; but it can be greatly improved by using thinner wires (0.06 mm to 0.08 mm diameter) and by using the instrument in a vacuum. The computed errors, due to the Peltier effect, are about 1 part in 300. The thermopile is not so well adapted as in the bolometer for instantaneous registration of radiant energy, and it does not admit so great a range in variation of sensitivity, but on account of its greater steadiness it commends itself for measuring very weak sources of radiation, for example, the extreme ultra-violet and infra-red region of the spectrum. A thermopile of bismuth-silver is described. It is easily constructed, and its sensitivity is from two and one-half to three times that of the iron-constantan pile. A surface thermopile is also described, the radiation sensitivity attained being six-sevenths the theoretical value. The Nichols radiometer can be made just as sensitive as the bolometer, but its period will be much longer. The Nichols radiometer is not selective in its action and hence can be used for measuring ultra-violet radiation. The main objection to the use of a Nichols radiometer is its long period, but since it is easily shielded from temperature changes and since it is not subject to magnetic perturbations, this long period is of minor importance so long as one is dealing with a constant source of radiation. In spectral-energy work its usefulness is limited to the region in which the window is transparent. The fact that the Nichols radiometer deflections cannot be obtained in absolute measure is a minor objection, since in only a few cases thus far at least has it been necessary to determine the deflection. The action of a Nichols radiometer is somewhat analogous to a photographic plate in that it will detect weak radiation, provided one can wait for it, and on account of its great steadiness it is, of all the instruments considered, probably the best adapted to search for infra-red fluorescence. A bolometer installation is so distributed that it is difficult to shield it from temperature changes. In spite of its small heat capacity the bolometer has a "drift" due to a slow and unequal warming of the strips. Air currents which result from the hot bolometer strips also cause a variation in the deflections of the auxiliary galvanometer. Nevertheless, despite these defects, it is the quickest acting of the four instruments considered and is the best adapted for registering the energy radiated from a rapidly changing source. For precision work it is necessary to keep the bolometer balanced to less than 1 cm deflection. A vacuum bolometer is described, and data are given showing that it is the quickest acting, the most reliable and the most sensitive of all the instruments described having a short period. The auxiliary galvanometer is the main source of weakness in measuring radiant energy, and in places subject to great magnetic perturbations a period greater than five seconds, single swing, is to be avoided. Notes are added on the Callendar radio-balance and a modification of the auxiliary galvanometer.—*Bulletin Bureau of Standards*, Vol. IX, No. 1, 1913.

Telegraphy, Telephony and Signals

Condenser Telephones.—KARL ORT AND JOSEF RIEGER.—An account of the advances made by the authors in the construction and application of condenser telephones. They first used impregnated thin tissue paper as dielectrics, but they are now using India rubber. The construction of a rubber condenser telephone is shown in Fig. 2. On an

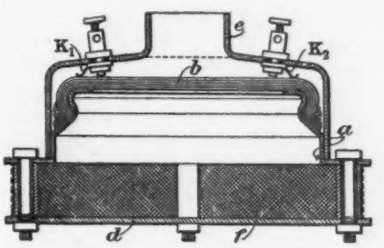


FIG. 2—RUBBER CONDENSER TELEPHONE

aluminum drum *a*, 10 cm in diameter, the rubber leaves are stretched in the manner of a drumskin. They are fixed around a periphery so that no irregular vibration can take place. Each leaf is from 0.3 mm to 0.5 mm in thickness and weighs about 400 mg. The drum is covered by a cap *e*, provided with contacts K_1 and K_2 making connection with the plates, and a back plate *d* is fixed at a distance from the case as a reflector for sound from the inner surface of the condenser. A polarizing voltage as high as possible must be used to secure good volume. The breakdown emf of the condenser used by the authors was between 500 volts and 600 volts, and for most experiments they used a unidirectional emf of 240 volts from lighting or motor-service mains. With 240 volts they found that the volume was equal to that of an electromagnetic loud-speaking receiver and increased substantially with emfs of 300 volts and 400 volts. The theory of the condenser telephone is given. The losses occurring in a condenser telephone are due principally to dielectric hysteresis and are exceedingly small with a rubber dielectric. The useful work done as sound is also extremely small, the phase-angle having been found by measurement to be very nearly 90 deg. In the electromagnetic telephone, on the other hand, losses from heating hysteresis and eddy currents combine to give an angle of much less than 90 deg., although the angle corresponding to the useful work is almost negligible. H. Abraham has estimated the efficiency of a receiver at 0.1 per cent. For loud-speaking purposes the condenser has the great advantage that the line current can be increased by using heavy-current transmitters, without any "rattling"

of the diaphragms.—From *Archiv. f. Electrotechnik* (abstracted in London *Electrician*, June 6, 1913).

Telephone Transmission Calculations.—A. J. Aldridge.—An abstract of a paper read before the (British) Institution of Electrical Engineers. The author considers the theory of telephonic transmission from the non-mathematical point of view, describing an apparatus for simplifying the calculations and showing its applications to various problems. Some experimental results are also given. The subjects discussed in some detail include calculations of loaded lines and reflection losses. The paper is to be concluded.—London *Electrician*, June 6, 1913.

Lead Alloys for Tapes.—A note on a recent British patent (No. 25,090, 1912) of the Weston Electric Company for the construction of tapes primarily intended for telephone switchboard cables. It is stated that by using an alloy composed of from 93.25 to 96.75 parts lead, 3 to 6 parts antimony and 0.25 to 0.75 part tin the tape need be only about half as thick as usual with pure lead tapes to obtain equal strength.—London *Elec. Eng'ing*, June 5, 1913.

Wireless Telegraph.—Sir Oliver Lodge.—A mathematical paper in the first part of which the author gives a summary of the principles and a mathematical theory of the Goldschmidt high-frequency generator for any number of circuits up to a magnifying ratio of 10. The second part of the paper deals with obstacles to electric wave transmission due to various kinds of opacity, or virtual opacity, in the atmosphere. It emphasizes the important influence which the highly conducting layer necessarily existing at a certain height must have, with fluctuations according to whether it is uniformly spherical or irregular in shape, and with reference also to the distribution and amount of its ionization. It is suggested that sunshine interferes with this layer either by altering its shape through heat or by making its transmission more gradual through general supply of beta particles. It is also suggested that under the action of solar radiation of all kinds electrons may be momentarily set free enough to promote several newly expected kinds of atmospheric capacity. Incidentally a useful practical expression for radiation from an aerial is given in an equation stating that the radiation power in kilowatts equals four times the square of the amperes times the square of the ratio of height to wave-length.—*Philos. Mag.*, June, 1913.

Miscellaneous

German Association of Electrical Engineers.—A report by G. Dettmar on the work of the German Association (Verband) of Electrical Engineers. The number of members is 5286. Twenty-two local societies belong to the association. A review is given of the work of the different committees.—*Elek. Zeit.*, June 5, 1913.

British Electrical Engineers in Paris.—An account by J. B. Picot of the proceedings of the joint meeting of the (British) Institution of Electrical Engineers and the Société Internationale des Électriciens in Paris.—*La Lumière Elec.*, May 31, 1913. The alphabetical registry list shows that there were present 230 French and 141 British electrical engineers.—*La Lumière Elec.*, June 7, 1913.

British Institution of Electrical Engineers.—An account of the annual meeting of the (British) Institution of Electrical Engineers. W. W. Duddell was re-elected president. An account of the annual report is given. At May 1, 1913, the membership of the institution was 7084 compared with 6537 last year. This total was made up of seven honorary members, 1549 members, 3535 associate members, 671 associates, 260 graduates and 1062 students. The corresponding numbers last year were 7, 1389, 3089, 806, 0 and 1247. —London *Electrician*, June 6, 1913.

Ebonite.—An account of exhaustive and severe tests of various grades on ebonite made at the British National Physical Laboratory for the purpose of preparing a specification of ebonite.—London *Elec. Review*, May 30, 1913.

Book Reviews

Dynamo Laboratory Outlines for Students in Electrical Engineering. By John Fay Wilson. New York: McGraw-Hill Book Company. 130 pages, illus. Price, $1.

A very practical laboratory manual for electrical engineering students. It consists essentially of a series of laboratory tests on electrical machinery and apparatus, giving the directions to be followed, the connections to be used, references in technical literature to be consulted and questions to be answered on the measurements. Twenty-three tests are recited in direct-current measurements and sixteen in alternating-current measurements, making thirty-nine in all. Each test contains ordinarily more than one series of observations to be made. The book will be useful to laboratory instructors of electrical engineering classes in colleges and technical schools.

The Electric Motor and Its Practical Operation. By Elmer E. Burns. Chicago: The Joseph G. Branch Publishing Company. 192 pages, illus. Price, $1.50.

Valuable information on electric-motor theory and practice is presented in this book in clear and simple language. The author states that he has treated the subject in a way to appeal to the practical electrician or mechanic who has not the technical training to master more advanced texts. The book would seem to be valuable in just that field. Starting with a brief account of the discoveries in the fields of magnetism and electricity, from which the electric motor was developed, the author quickly takes up the practical explanation of power and efficiency, counter-emf and losses. Windings and commutation are discussed, and the three main types of direct-current motors are explained, together with the necessity and use of starting equipment. Some attention is also paid the subject of alternating-current motors. The last three chapters of the book are devoted to the general subject of motor applications and operation, covering speed-control methods, motor troubles and problems of selecting and installing motor equipment. In the appendix is given a valuable tabulation of machines used in various industries and the approximate power required to drive them.

Wireless Telegraphy and Telephony Simply Explained. By Alfred P. Morgan. New York: The Norman W. Henley Publishing Company. 154 pages, 156 illus. Price, $1.

The book represents an effort to tell the main facts in the story of wireless signaling in an attractive and easily understandable form. It cannot be classed either as deeply theoretical or as giving a comprehensive practical treatment, but it occupies a middle ground, containing sufficient simple theory and enough practical detail to make it valuable as a source of general information. An explanation is given of some elementary theory and its bearing on wireless phenomena. Then the subjects of transmitting apparatus and operation, receiving apparatus and methods and the theory of tuning and couplings follow in logical order. The section devoted to wireless telegraphy closes with a chapter on its applications along commercial, naval and military lines. There is next given some matter relating to the human ear and to various forms of speech transmission, followed by a lengthy discussion of the subject of wireless telephony. The reader should be warned that, while a good deal has been accomplished in this field, the wireless telephone is still far from a commercially practicable thing. In the closing chapter the author indulges in some mild speculations as to possible future developments along these lines, and particularly with reference to wireless energy transmission.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Pull Receptacle for Outlet Boxes

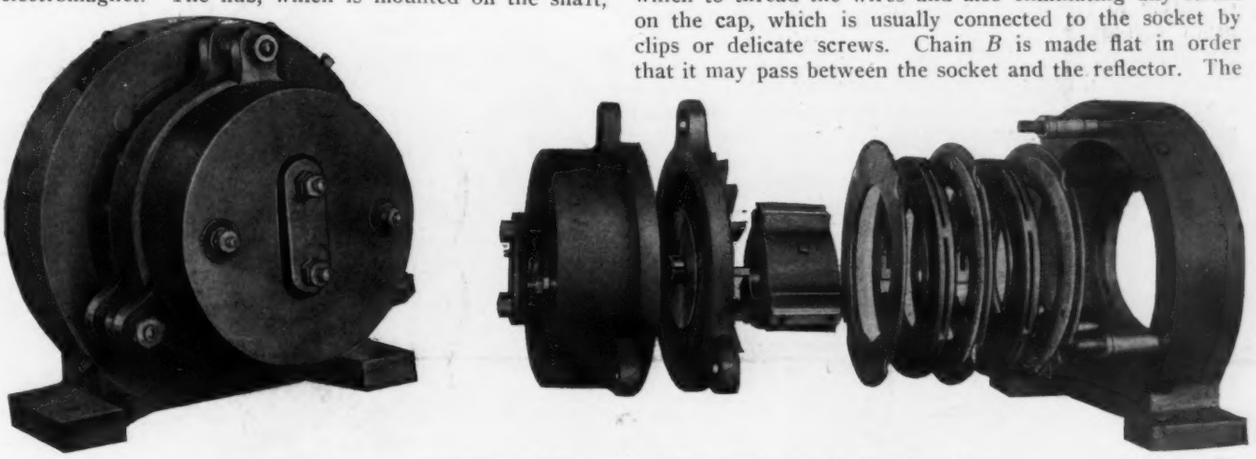
In the past it has been the practice to mount on outlet boxes a pull receptacle which had been primarily designed for use as a wall receptacle, as there was no especialy designed receptacle for outlet boxes. The firm of Pass & Seymour, Inc., is placing on the market a pull receptacle for use with 4-in. wall boxes. The porcelain projecting ring shown in the accompanying illustration insulates the metallic shell from the box and from the ceiling, thereby permitting its use on metal work. This device is fitted with a pull chain as indicated.

PULL RECEPTACLE

Ventilated Magnetic Brakes

The selection of the correct size of magnetic brake has in the past been more or less a matter of guesswork, as the brakes have usually been rated by the manufacturers in horse-power. This manner of rating has been rather indefinite, since the size of the brake required depends upon other factors of service. To eliminate uncertainty and to allow the selection of the proper size of brake for all cases the Cutler-Hammer Clutch Company, Milwaukee, Wis., has developed for the market an improved type of ventilated magnetic brake rated in horse-power, maximum torque in pounds-feet, and work in foot-pounds per minute. These brakes consist of a hub, a series of stationary and rotating disks, an inclosing case, a spiral spring and an electromagnet. The hub, which is mounted on the shaft, carries the rotating disks. These disks are interleaved between the stationary disks which are anchored to the inclosing case. The friction linings on the stationary disks are made from a patented product consisting of a weave of asbestos and brass wire and are riveted to the stationary disks by countersunk copper rivets. The material of these linings has been chosen on account of its wearing and braking qualities, determined by a comprehensive series of tests.

The rotating disks are provided with internal radial air passages similar to those found in the runner of a centrifugal pump. When set in motion, air is drawn through inlet passages in the hub and ejected from outlets provided in the side of the disk-inclosing frame under the cover. The ventilation secures better capacity and wearing qualities. No lubrication is required and little attention is said to be necessary. Normally, the stationary and rotating disks are pressed into frictional engagement by means of a spiral spring. The electromagnet serves to compress this spring and release the pressure on the disks when it is desired to release the brake. The intensity of the braking force can easily be adjusted, and brake application and release are made without shock or hammer. The actuating forces being balanced within the brake, no end-thrust is imposed on the shaft to which they are attached. All parts of the brake are easily accessible, as loosening the three bolts at the end of the magnet case, shown in Fig. 1, allows the disks to be slid out along the shaft.

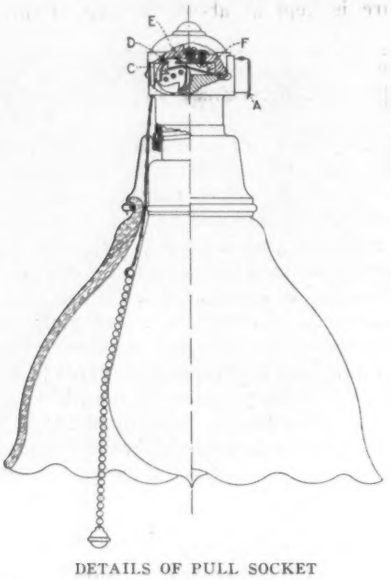


FIGS. 1 AND 2—END VIEW AND DISASSEMBLED VIEW OF MAGNETIC BRAKE

Vertical Chain-Pull Angle Socket for Incandescent Lamps

A vertical, straight-away chain-pull angle socket for incandescent lamps has been put on the market which possesses several creditable features. The accompanying cross-sectional view of the assembled socket lamp and reflector shows the interior details. Wires supplying the lamp with electricity enter the socket through the bushing marked *A*, which is rigidly fastened to the socket and not to the cap, thus avoiding any right-angle turns through which to thread the wires and also eliminating any strain on the cap, which is usually connected to the socket by clips or delicate screws. Chain *B* is made flat in order that it may pass between the socket and the reflector. The lower end of the chain consists of the usual series of beads which constitute a majority of the pull chains used at present. The chain operates the cam-shaped fiber piece *C*, every other tooth of which bears a metal strip *D*. Spring *E* is connected to one of the wires furnishing the lamp with electricity; spring *F* is neutral in the position shown and is secured to a fiber block at its right-hand end. Strip *D*

is connected through the axis of the cam *C* to the central terminal of the incandescent lamp. When the chain *B* is pulled from the position shown, *C* turns counter-clockwise, raising spring *F* into contact with *E* and at the same time making contact with *D* and lighting the lamp. Another pull of the chain rotates the cam farther in the direction stated with a snap movement, during which two



DETAILS OF PULL SOCKET

series gaps are inserted in the circuit by the separation of *D* and *F* and *F* and *E* respectively. The series break assisted by the snap action of the cam extinguishes the arc which occurs on breaking the electric circuit. The chain pulls along the tangent to the cam, and the action is very easy and thus relieves the fixture of considerable strain. The socket is manufactured by the Benjamin Electric Manufacturing Company of Chicago.

Safety Device for Line Crossings

To protect the conductors of transmission lines from arcs occurring at the insulators and to give greater assurance of safety to telephone or low-tension wires crossing beneath high-tension leads the Clark Electric & Manufacturing Company, of 149 Broadway, New York City, has developed several types of overhead clamping sets. In Fig. 1 are shown typical clamps for use in connection with woooden poles on lines carrying a potential of 2300 volts or less.

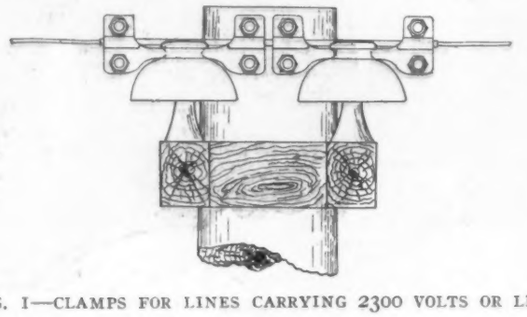


FIG. 1—CLAMPS FOR LINES CARRYING 2300 VOLTS OR LESS

These insulator clamps are made either of a copper composition possessing high tensile strength or of galvanized or sherardized malleable iron and are fitted with galvanized or copper-plated steel bolts. It is said that in some localities the copper clamps give better satisfaction when used on bare copper conductors and the iron clamps on steel or aluminum conductors as this arrangement precludes the possibility of electrolytic action occurring between the two metals.

The type of overhead clamping set shown in Fig. 2 has been designed to meet railroad companies' specifications for high-tension line crossings. The turnbuckle shown in the figure is provided to take up any variation in dimensions between the insulators but may if desired be replaced

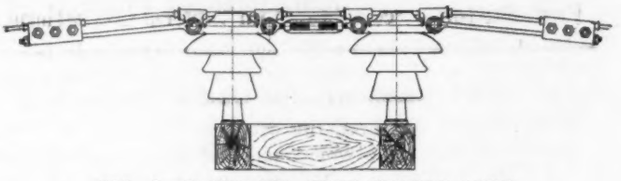


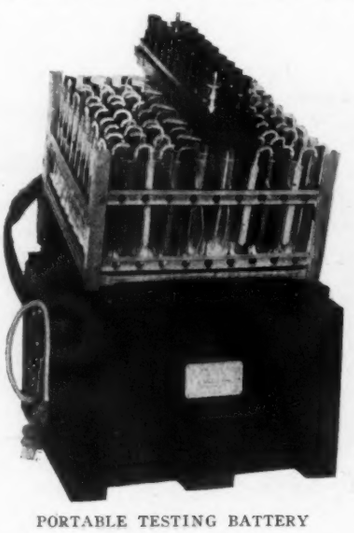
FIG. 2—CLAMP FOR HIGH-TENSION LINES

by a flat steel bar. These insulator clamps are sometimes made with upper as well as lower bolts and a top connecting member. Either copper or aluminum bushings, depending on the nature of the conductor, are provided at the clamp to prevent injury to the line wire.

It is stated that tests have been made which show that although the conductor may become severed at a point over the head of the insulator directly between the clamping members of the set, the broken line wires will not be pulled through the clamp.

Portable Testing Battery

The portable testing battery sets manufactured by Mr. E. Marcuson, of 136 Liberty Street, New York City, described in the *Electrical World* Feb. 17, 1910, have recently been improved by the addition of switching apparatus which quickly puts at the command of the operator any one of a number of different potential values. Formerly different voltages were obtained by the use of a "tapping clip," but that method was found to be inconvenient. In the accompanying illustration is shown a 160-volt battery equipped with such a switch. The eight cells in this battery are arranged in ten equal groups, each capable of giving 16 volts. By means of the switch any or all of the ten sections may be connected to the two binding posts in any manner desired. By placing the switch arms in the proper posi-



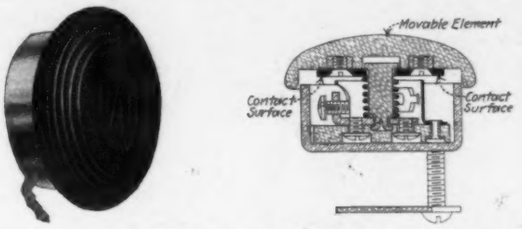
PORTABLE TESTING BATTERY

tions the following voltage combination can be obtained: 16, 32, 48, 64, 80, 96, 112, 128, 144, 160 volts; 80 volts multiple series; 16 volts multiple series. The spring clip attached to the side of the box may be used for tapping at points in any section for obtaining intermediate voltage steps. The dimensions of the containing box of the 160-volt battery are 10.5 in. by 10.5 in. by 7 in. and the total

weight of the battery ready for use is 34 lb. All parts of the battery are visible, accessible and removable, and it is claimed that the low maintenance cost of these outfits allows them to compare favorably with other types of potential batteries.

Push-Button Accessible from Several Directions

An electric push-button for operating automobile horns, which can be pressed from a variety of directions, is shown in the accompanying cross-sectional view. The novel feature of this push-button is the fact that the top as a whole is the movable element. With this design of push-button it is possible to close the contact by pressing it on the side or top with the elbow when it is not within easy reach of



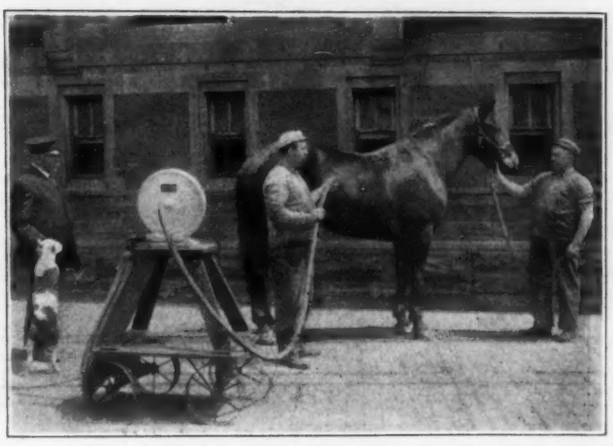
FIGS. 1 AND 2—EXTERNAL VIEW AND CROSS-SECTION OF BUTTON

the fingers. The device is 1.875 in. in diameter and can be clamped to one of the arms of the steering wheel. The device is manufactured by the Dean Auto Devices Company, Chicago.

Vacuum Horse-Grooming Set

The New York City park department has recently purchased a motor-driven vacuum horse-grooming set for the Central Park stables. By the use of this machine the effectiveness of the usual curry comb is obtained with the added advantage of the removal of all dirt and dandruff in a sanitary manner. The dirt is not brushed from place to place and does not get into the air to be inhaled by the groom, but is instantly sucked away through a vacuum hose and blown into a gunnysack.

The illustration shows the park department's horse-grooming set mounted upon a special truck for ease in



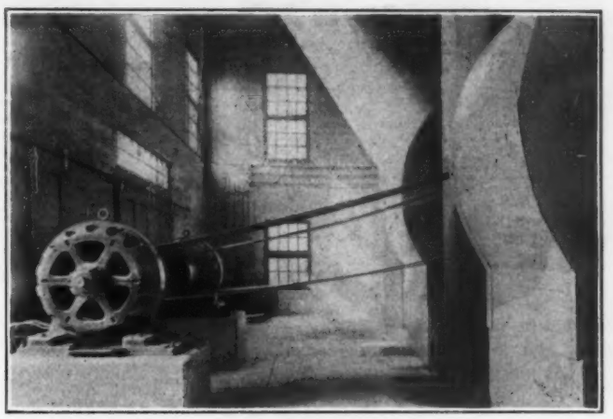
MOTOR-DRIVEN HORSE-GROOMING SET

handling. As the set weighs only a few pounds and can be carried by hand the truck may be dispensed with if it is desirable. The horse-grooming set is particularly effective in removing all of the loose hairs after clipping.

This electric vacuum-cleaner horse-grooming set was built by the B. F. Sturtevant Company, Hyde Park, Boston, Mass., and was sold by the Western Electric Company.

Pre-Cooling Refrigerator Cars Electrically

The accompanying illustration shows two 7-ft. Sirocco blowers driven by 75-hp motors which are used by the Pacific Fruit Express Company, Roseville, Cal., for pre-cooling fruit cars previous to filling their refrigerators with ice. Air is drawn from cooling rooms, in which the temperature is kept at about 18 deg. Fahr. by direct-



MOTORS DRIVING SIRROCO BLOWERS

expansion ammonia coils, and is forced into the cars, reducing their temperature and effecting a considerable saving in ice during transportation.

By means of specially designed motor-driven valves the air current can be reversed so that the fans exhaust foul air from the cars previous to pre-cooling. The motors for this installation were supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Universal Armature Winding Machine

Many repair men have found that small motor armatures cannot be rewound by hand at a price which will justify attempting the work. An armature-winding machine which will wind any small drum armature having diametrical or skewed chord windings in straight, open or

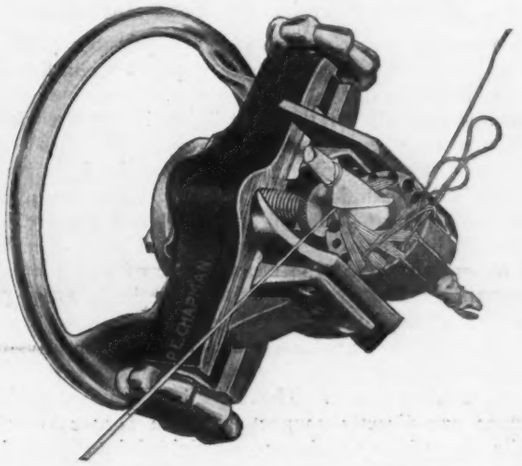


FIG. 1—ARMATURE WINDER WITH SMALL ARMATURE IN JAWS

overhung slots is shown in Fig. 1. The machine consists of a universal two-jaw chuck to hold the armature, the jaws being shaped to guide the wire into the slots. The screw stops seen between the jaws are used for fixing the point at which the jaws grip the armature so that when the upper slot is correctly set and the armature held against the stops the other slot will be in the correct position to

receive the wire. A wrench wheel of such proportions that it will not permit the operator to exert excessive pressures upon the armature cores is provided for tightening the clamping jaws. The large hand-wheel which is seen at the back of the machine is valuable for stopping and backing and for turning the armature slowly in starting or finishing the coil.

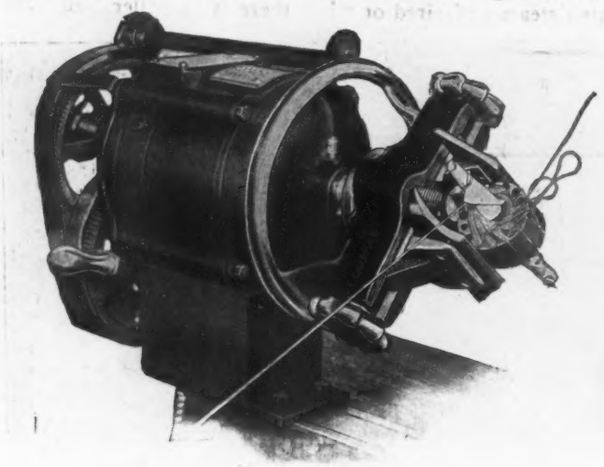


FIG. 2—SUGGESTION FOR MOUNTING ARMATURE WINDER

For driving the armature winder a 1/6-hp motor operating at from 300 r.p.m. to 400 r.p.m. is recommended when used with a foot controller. The drive should have a revolution-counter attachment for recording the number of turns of wire. The coils are wound successively, and the armature is shifted after the required number of turns have been placed. For winding armatures with skewed slots the jaws are made adjustable to any diagonal line and the winding operation is identical with that for straight slots. Fig. 2 contains a helpful suggestion for mounting the armature winder.

This machine has recently been put on the market by the P. E. Chapman Electrical Works, of Tenth and Walnut Streets, St. Louis, Mo.

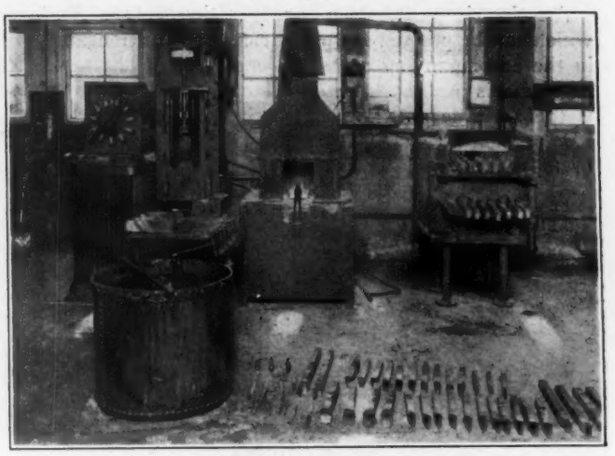
Electric Furnace for Tool Hardening

To harden properly the many tools and dies in the mammoth plants of the present day requires scientific methods and reliable apparatus. In the electric furnace shown herewith the crucible for the bath is lined with firebrick slabs cemented together to prevent leakage of the bath. The dimensions of the crucible are 8 in. by 8 in. by 12 in. deep, although the bath is only 8 in. deep. The lining is surrounded by heat-insulating material and the entire container is held in a sheet-iron case. Two iron electrodes on opposite sides of the crucible are of sufficient area to allow the current to flow through practically every part of the bath, thereby insuring uniform temperature.

A regulating transformer is provided for varying the potential impressed on the bath and consequently the temperature of the bath. The secondary coils of this transformer are directly connected to the furnace electrodes, while the primary coils are subdivided into a number of sections, taps from the latter being brought out to a dial switch. By turning the dial through two revolutions twenty-one adjustments can be made, varying the temperature from that necessary to keep the bath just above the freezing point to that required to start the furnace.

For hardening carbon steel where the temperature required varies from 750 deg. to 1000 deg. C. a mixture of barium chloride and potassium chloride is used. For ordinary tool steel equal parts by weight of the salts are recommended. For hardening high-speed steel, where temperatures up to 1300 deg. C. are required, barium chloride only should be used.

The equipment shown in the illustration is installed in a blacksmith shop for hardening high-speed steel and about 65,000 tools are handled per year. The tools are first placed in the preheater, which is oil-fired, the air blast having a pressure of 8 oz. The shelf on the front of the preheater

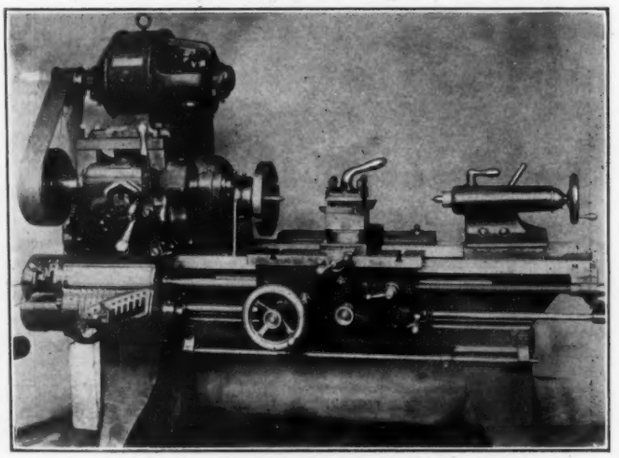


ELECTRIC FURNACE AND AUXILIARY EQUIPMENT

is used as a receptacle for the tools which are to be hardened. The tools are quenched in the oil bath shown to the left, which is agitated by air to keep it cool. The electric furnaces described above are manufactured by the General Electric Company, Schenectady, N. Y.

Motor-Driven Geared-Head Lathe

The illustration herewith shows a motor-driven 16-in. geared-head lathe designed to meet conditions imposed by the use of high-speed steels. The controlling levers are all within easy reach from one position in front. There are eight mechanical changes of speed for the spindle with the main shaft running at a constant speed of 900 r.p.m. On four speeds the spindle is driven directly through the



MOTOR-DTIVEN GEARED-HEAD LATHE

tumbler and gear cone, and on the other four it is driven through the back gearing. The minimum spindle speed is 11 r.p.m. and the maximum speed is approximately 687 r.p.m.

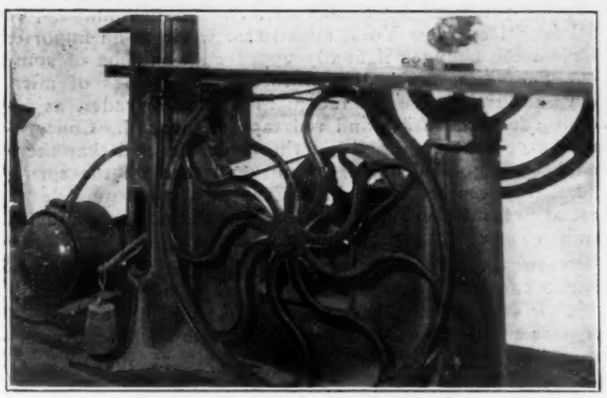
The headstock of the lathe is of the improved tie-bar pattern, with annular bearings of special metal. The carriage is stopped automatically at the end of the desired

travel when either feeding or screw cutting—an arrangement that is highly valuable for internal work and for duplicating pieces.

The lathe, which is manufactured by the Hendey Machine Company, Torrington, Conn., is driven by a 2.75-hp Westinghouse motor.

Inclosed Motor in Woodworking Plant

Totally inclosed motors are now deemed a necessity in a woodworking shop as a security from damage by fire. In the illustration herewith is shown a totally inclosed motor with automatic controller operating a band-saw. The motor is fitted with solid cast-iron end-bonnet on the pulley end and provided on the commutator end with inclosing doors which lock with a wing nut latch and are hinged to



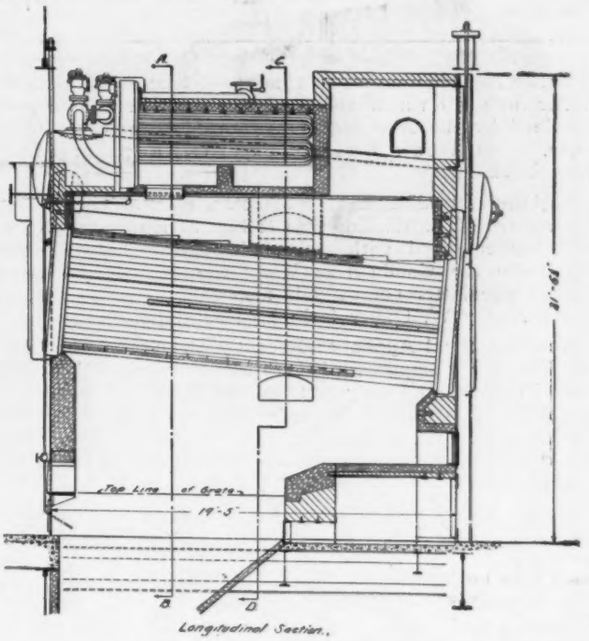
INCLOSED MOTOR DRIVING BAND-SAW

open either side. In this manner ready access to the commutator is gained. An inclosing block of porcelain protects the terminals so that a hammer or other tool accidentally dropped on top of the motor does not endanger the shop or the motor itself through arcing or short-circuiting. Although totally inclosed, this machine operates at a temperature rise of less than 50 deg. C. under continuous full load. The motor, which is rated at 2 hp and operates at 1100 r.p.m. on 220-volt direct-current circuits, is made by the Diehl Manufacturing Company, of Elizabeth, N. J.

Double-Pass, Two-Drum Boilers

The illustration which is presented herewith shows a longitudinal section of a 635-hp boiler with superheater which is in operation at the Grand Central Terminal in New York City. The horizontal baffling on the lowest row of tubes may be seen extending over the furnace and back over the bridge wall, forming the roof of the combustion chamber. In this boiler the middle baffle is located on the ninth row of tubes and consists of a special cast-iron baffle extending from the rear water-leg toward the front water-leg with a sufficient opening for the passage of the gases. On the top row of tubes are placed T-tiles extending from the front water-leg to within a few feet of the rear water-leg. The effective path of travel of the gases is long and the boiler surface is compactly arranged, so that there is efficient absorption of the heat in the gases, even with the comparatively high furnace temperatures resulting from the design of the combustion chamber.

Another interesting point shown in this drawing is the superheater design. Two superheater units placed above the water line in a firebrick chamber are used for each boiler. A flue connects each chamber with the furnace, and a small percentage of the furnace gases flow up these flues and supply heat to the superheater tubes. The hot gases make two passes over the superheater and then flow out of the superheater chamber at the end nearest the front header, and before reaching the uptake they pass under the boiler drum. A damper in the superheater outlet gives complete control of the amount of gases flowing over the tubes, thereby permitting temperature regulation and also the entire cutting off of the supply of hot gases when saturated steam is desired or when there is no boiler load. No



635-HP BOILER WITH SUPERHEATER

provision is made for flooding the superheater as that operation is unnecessary. Since flooding is unnecessary, deposits of scale-forming impurities are not made within the superheater tubes.

The performance of one of these 653-hp units at the serv-

TEST OF 635-HP HEINE BOILER WITH SUPERHEATER

Square feet of shaking grates	125
Coal Analysis, made at Harris Laboratory, New York City:	
As received:	
Moisture	4.96
Ash	20.92
Heat units, per lb. coal	10,880
Dry coal—	
Ash	22.02
Heat units per lb. coal	448.00
Total Quantities:	
Duration of run in hours	8.166
Total weight of coal as fired, lb	26,075
Total weight of water fed to boiler, lb	164,205
Hourly Quantities:	
Dry coal per hour, lb	3,035
Equivalent water per hour from and at 212 deg. Fahr., lb	26,040
Average Pressure and Temperatures:	
Steam pressure, lb. gage	176
Temperature feed water, deg	41
Superheat, deg. Fahr	122
Horse-Power:	
Hp developed	755
Per cent rating	119
Economic Results:	
Water apparently evaporated per lb. coal, actual conditions	6.30
Equivalent evaporation from and at 212 deg. per lb. coal as fired	8.16
Equivalent evaporation from and at 212 deg. per lb. dry coal	8.58
Efficiency:	
Over-all efficiency of boiler superheater and furnace	72.67

ice station of the Grand Central Terminal is given in the accompanying table. The test was made with No. 2 buckwheat anthracite coal and natural draft, and an efficiency above 70 per cent was obtained. The boiler was manufactured by the Heine Safety Boiler Company, St. Louis, Mo.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Boiler Equipment Sent to Mexico.—An order for a 260-hp boiler for use on a Mexican sugar plantation was recently obtained by the Abendroth & Root Manufacturing Company, through Carr Brothers, exporters, of 32 Broadway, New York.

Lighting Installation at Rochester, N. Y.—The department store of E. W. Edwards & Son at Rochester, N. Y., is being equipped with wall and pendent fixtures—1000 in all—by the Goodwin & Kintz Company, of Winsted, Conn. The latter company is also supplying the fixtures in the Henry W. Oliver Building in Pittsburgh, Pa.

New Electrical Appliance Recently Put Out.—The Shelton Electric Company, of 14 East Forty-second Street, New York, has recently put on the market a new form of electric drink mixer for soda fountain and similar use. The apparatus, it is claimed, is more efficient and more serviceable than other machines previously employed for this work.

Electrical Business Good in the Carolinas at Present.—From Robinson, Nelson & Company, electrical supply dealers and jobbers, of Richmond, Va., word is received to the effect that business conditions in and about that city have been somewhat dull during the month of June, but that their business in both North and South Carolina has been very good.

Safety Lamp Approved by the Bureau of Mines.—The Ceag portable electric mine lamp, made by the Mannesmann Light Company of America, 55 John Street, New York, has recently been tested and approved by the Bureau of Mines and certified as permissible for use in gaseous mines. The company is planning to start an active campaign for the introduction of the improved device into the coal-mining and allied industries.

Adjustable Fixture Hangers Used in Big New York Buildings.—Among the large buildings in New York City recently equipped with the Knight adjustable fixture hangers are the Municipal Building, the new Stern Brothers department store, on West Forty-second Street, and the Hotel Theresa, at 125th Street and Seventh Avenue. A number of apartment houses have also been furnished with these hangers. They are manufactured by the Empire Engineering & Supply Company, of 227 Fulton Street, New York.

Biscuit Company Equips a Large Plant in New York.—The Loose-Wiles Biscuit Company, of Kansas City, Mo., has put up a large plant in Long Island City and has placed orders recently for extensive mechanical and electrical equipment for the same, including a 1500-hp Babcock & Wilcox boiler and superheater, three 625-kva Curtis turbo-generators, a 25-kw and 15-kw exciter set, a 14-kw motor-generator set, and 105 motors of ratings between 2 hp and 35 hp for drive purposes in various parts of the factory. The electrical apparatus is all of General Electric make.

General Electric Sales to Industrial Companies.—Electrical generating, drive and control apparatus of General Electric Company manufacture will be installed in the near future by the following industrial and railway companies: American Printing Company, Fall River, Mass., two 1500-kw Curtis turbo-generators; Atlas Portland Cement Company, Ilasco, Mo., eight synchronous motors of various ratings, with exciter equipment, nine 215-kva transformers, three 600-kw rotary converters and switchboard panels; Fisk Rubber Company, Chicopee Falls, Mass., motors and switchboard apparatus; Robert Gair Company, Brooklyn, N. Y., a 300-kw Curtis turbo-generator; Colgate & Company, Jersey City, N. J., a 500-kva generator, a 22-kw exciter and switchboard; Delaware & Hudson Company, of Albany, N. Y., a 665-kva frequency-changer set and switchboard apparatus, and the Fort Dodge, Des Moines & Southern Railroad Company, of Des Moines, Ia., thirty-nine motors of ratings between 1 hp and 50 hp, and thirteen transformers with switches and control panels.

Mica Schedule Thought Too Complicated.—Interviewed early this week as to the effect of the change in the mica schedule proposed by the Senate, A. O. Schoonmaker, of 66 Park Place, New York, stated that while as an importer of mica the changes if finally approved would be of some benefit to him, especially on the higher grades of mica, he would rather see a uniform rate for all grades, as involving less confusion and red tape all around. Concerning the present conditions in the trade, he said that there had been a good demand for mica all through the spring and that prices had been maintained at a fairly good level. Just at present there is a slight falling off, due to the usual summer let-up in general business activity.

Present Status of the Tariff.—On June 20 the Senate finance committee completed the draft of a new tariff bill which is designed to replace the Underwood bill and which contains some rather unusual features both of general interest and of particular interest to the electrical industry. A large number of changes were made in the rates proposed in the House bill and the estimated net result is a gain of about $5,000,000 in revenue, but, contrary to the custom in past years, when the Senate has invariably suggested material increases in rates, there are only a few classifications on which important increases have been made. The free list was extended considerably in the Senate bill and the general tendency was to reduce the rates on necessities and increase those on articles and material of secondary importance. Several changes were made in classifications of special interest to electrical manufacturers and importers of material used in that industry. In place of a 30 per cent duty on mica and manufactures of mica there were promulgated the following rates: value 15 cents per lb. or under, 4 cents per lb.; between 15 and 75 cents per lb., 25 per cent; over 75 cents per lb., 20 per cent; cut mica, 30 per cent. The net result of the change is thought by importers to be a little in their favor. The carbon schedule has been extended by the addition of the classification "carbons for flaming-arc lamps not especially provided for," on which a duty of 30 per cent is proposed. This means, if it is passed, that the duty on high-grade German and Austrian electrodes will be materially increased, since under the classification in the Underwood bill these electrodes were to be admitted at the same rate as the ordinary lamp electrode, namely, 15 cents per 100 ft. Importers of these high-grade electrodes claim that the proposed rates will be almost prohibitive and will greatly retard the growth of the flaming-arc-lamp industry in this country. In the iron, steel and aluminum schedules there were substantial decreases in rates on the rougher grades and scrap and slight increases on the fabricated forms. The revised bill was submitted to the Democratic caucus on June 21 by Senator F. M. Simmons, chairman of the Senate finance committee. It was predicted that within a week it would be reported to the Senate. No definite action had been taken on the income-tax feature of the bill at this writing, but the section relating to the examination of the books of foreign manufacturers (which has caused much unfavorable comment and some rumors of retaliatory measures by European governments) was eliminated, along with the proposed plan for a reduction of 5 per cent on goods imported in American ships. It is very probable that provision will be made for an increase in duty by the President's order in the case of imports from countries which discriminate against the United States.

Underground Construction for Dallas.—The Dallas Electric Corporation, Dallas, Tex., has appropriated approximately $1,000,000, to be used in placing all the overhead distributing lines underground on Elm Street between Market and Harwood Streets, and on Main and Commerce Streets between Market and Central Avenue. When this change is completed all poles excepting those carrying the overhead trolley wires will be removed from the streets as named. According to existing plans the underground system will be installed in 1¼-in. sherardized duct, and distributing lines will be No. 6 armored cable, jute-covered.

Metal-Filament Lamps Preferred.—During 1912 there was a notable increase in the production of metal-filament incandescent lamps in Germany, accompanying improvements in quality which make this type preferable to the old carbon lamp. Price conditions, however, have been extremely unsteady. Ruinous competition between lamp manufacturers, accompanied by price cutting and the granting of rebates, resulted disastrously for a number of the weaker concerns, which were finally absorbed by the larger ones. At the present time there are only two large companies engaged in this business, the German General Electric Company and the Siemens-Schuckertwerke.

New Corporation to Handle Electric Railway and Central-Station Equipment.—The I. S. Van Loan Railway Equipment Company, with general offices at 233 Broadway, New York, and factory at Reading, Pa., has been recently incorporated for the manufacture of railway motor supplies and controllers, the supplying of complete equipments for generating stations and electric railways, either new or second hand, and the financing of railway and lighting properties, new or reorganized. The company's officers are E. W. Samuel (president of the Shamokin & Mount Carmel Transit Company), president; I. S. Van Loan, of New York City, vice-president, and A. C. Case, of New York City, secretary-treasurer.

Plan to Boom "Hylo" Lamps.—At the recent convention of the National Electric Light Association in Chicago there was exhibited by the Economical Electric Lamp Works of the General Electric Company a miniature theater working automatically and showing various rooms in a modern dwelling where the "Hylo" lamp can be used to advantage. The company is so well satisfied with the results of this experiment that it is planning to send out ten similar exhibits for use among the larger cities, and the campaign will be carried to the smaller centers by means of 500 display pieces, arranged to show the mechanical operation of this type of lamp as well as its comparative rates of consumption with full and with reduced candle-power filaments in operation.

Electro-pneumatic Power in Stonecutting.—Stonecutters, particularly those engaged in dressing, lettering or carving monuments and gravestones, find compressed air, supplied by an electric motor driving a compressor, very convenient in operating their cutting tools. The electro-pneumatic tools are much more efficient and convenient than chiseling by hand, particularly where the letters or designs are in high relief. A stonecutter who has a shop on Capitol Avenue in Springfield, Ill., reports that the installation of a small electric motor belted to an air compressor, with a storage tank, flexible air pipes and an equipment of cutting tools, permits him, at an expenditure of about $7.50 a month for electrical energy, to do work which, for both quantity and quality, he could not hope to do by hand.

New Brush Material to Be Placed on the Market.—The Graphite Metallizing Corporation, of Yonkers, N. Y., will put on the market shortly a new material, to be known as "metaphite," consisting of graphite impregnated with various metals, according to the service for which it is to be used. Graphite brushes impregnated with copper will be furnished for use on alternating-current and low-voltage direct-current generators and motors, and the same material impregnated with either brass or copper will be supplied for contacts on electric controllers. The use of this material in the mechanical field should be large, particularly in the construction of self-lubricating bushings consisting of a graphite body impregnated with babbitt metal or bronze. Such use would probably be confined to light duty machinery where it is either difficult or objectionable to use oil lubrication.

Predicts a Fine Future for Louisville, Ky.—Henry M. Byllesby, of Chicago, president of H. M. Byllesby & Company, was in Louisville recently on business connected with the consolidation of the local heating and lighting companies into one corporation under the Byllesby management. Mr. Byllesby was accompanied by Messrs. Stearns and Milkewitch, of Byllesby & Company, and he met General George H. Harries, vice-president of H. M. Byllesby & Company, in Louisville. To a reporter Mr. Byllesby said that his company has invested a large amount of money in Louisville and has demonstrated thereby its faith in the future of the city. Mr. Byllesby continued: "Personally I am, and have been for some time, much impressed with the possibilities for development at Louisville. The city is growing steadily and substantially; it is well placed for trade and has, I think, a fine future."

Terry Turbines in Demand for Numerous Services.—At the present time there are on order about fifty turbo-generator sets, according to recent advices from the Terry Steam Turbine Company, of Hartford, Conn. A glance at the list of purchasers shows the variety of the service requirements involved and the wide geographical distribution of these orders. Prominent among the purchasers of these turbines are the following: Navy Department, for the torpedo boat destroyers *O'Brien, Nicholson* and *Winslow,* and for the U. S. S. *Mayflower;* J. G. White Engineering Corporation, for the Marconi wireless station at Honolulu, Hawaii; Detroit Shipbuilding Company, Detroit, Mich.; Stone & Webster Engineering Corporation, for the Pensacola Electric Light Company, the Boston Woven Hose & Rubber Company and the Blackstone Valley Gas & Electric Company, of Pawtucket, R. I.; Omaha (Neb.) & Council Bluffs Street Railway Company; Atchison, Topeka & Santa Fé Railroad Company, of Kansas City, Mo.; Arctic Ice Manufacturing Company, of New York; Robert B. Brigham Hospital, Boston, Mass.; Maryland Steel Company, Sparrow's Point, Md.; Palmetto Phosphate Company, Tiger Bay, Fla., and the Johns-Pratt Company, Hartford, Conn. It is worthy of special note that the installation for the Blackstone Valley Gas & Electric Company comprises a type C turbine, a 100-kw General Electric generator and a 150-hp General Electric motor, all mounted on the same base, with the generator so arranged that it can be operated from either source of power.

Progress on the Big Marconi Wireless Stations.—It is estimated that by the latter part of October of this year work will be completed on the big wireless stations started last fall by J. G. White & Company, Inc., for the Marconi Wireless Telegraph Company of America. Some interesting details of these stations were given out in an interview with one of the engineers of the latter company several days ago. The sending aerials at the Honolulu station are to be supported by twelve steel towers 380 ft. high, arranged three at each end, with three groups of two spaced at intervals of about a quarter of a mile. Heavy cables will be stretched between the towers of each group and the antenna wires will be supported by these cables. At this station there are to be two sending and two receiving aerials, so that messages can be handled in both directions between the Pacific Coast and Japan. The energy for the Hawaiian station will be supplied by two similar sets, with a third set for emergency use. Each unit will consist of a 300-hp Babcock & Wilcox boiler furnishing steam to a 500-hp De Laval turbine driving a 300-kva Crocker-Wheeler alternator. The boilers are to be oil-fired and will be equipped with superheaters for 200 deg. superheat. There will also be installed at this station two Terry steam turbines dhiving 100-kw direct-current generators for excitation, lighting, pumping and other auxiliary service. At the stations in California and New Jersey motor drive will replace the steam equipment, the rest of the installation being essentially the same as that above described. There will be, however, in each of these cases but two units, one for reserve. A fourth station is projected and plans have been drawn for it which is to be located in New England and operate between the United States and Norway. On the stations now in process of erection, besides the apparatus above mentioned, the switchboard equipment was supplied by the General Electric Company, of Schenectady, N. Y.; the antenna and guy wires (both made to specifica-

tion) by the John A. Roebling's Sons Company, of Trenton, N. J., and the steel for the towers by the McMeiller Interstate Company, of Cleveland, Ohio. Most of the special wireless apparatus was supplied by the British Marconi Company.

Electrical Industry in Germany Growing.—With the exception of turbine and lamp prices, which were unsteady during 1912, the prices obtained for German electrical material and apparatus during that year were an improvement over those for 1911. The German export trade in electro-technical products was larger both in volume and in value during 1912 than for the previous year. The shipments of generators, motors, transformers, electric lighting and energy transmission apparatus, telephone and telegraph instruments and supplies, signaling devices, incandescent and arc lamps, all showed an increase over those for 1911, but the exports of electric cable showed a falling off from the figures for that year.

Generating Stations Increase Their Equipment.—Additions will be made shortly to the electrical equipment of the following central stations: Great Falls Power Company, Butte, Mont.; South Carolina Development Company, Peake, S. C.; Columbus Power Company, Columbus, Ga.; Georgia-Carolina Power Company, Augusta, Ga., and Eastern Michigan Power Company, Jackson, Mich., the latter two concerns being the heaviest purchasers. The apparatus to be installed includes generators, transformers, motor-generator and rotary-converter sets, one large frequency changer and a large amount of switchboard apparatus, all of which is being supplied by the General Electric Company, of Schenectady, N. Y.

Electric Railway Extensions in Brazil.—Because of the rapidly increasing demand for rapid transit in the city of Bello Horizonte, Minas Geraes, Brazil, it has been decided by the Empraza de Electricidade e Viacao Urbana, of that place, to add 1600 hp to its motive power and to make improvements on its transmission line, for which latter item orders have been placed for structural steel towers. The new line will use a larger conductor than was formerly employed and will be about 25 miles long, with 300 towers and 27 posts, the latter being used within the city limits. Work on the new construction began early this year and a number of the towers have already been placed. Further increases in the generating equipment are contemplated and additions are to be made to the rolling stock. Plans are also on foot for double-tracking along many of the streets of the city.

Electricity and the Automobile.—Conferences recently held at some of the principal automobile factories between dealers and car designers foreshadow a decided increase in electrical applications upon gasoline-motor vehicles for the 1914 trade. At least two makers have adopted the electrical gear shaft, which eliminates the need of a shift lever requiring an appreciable time for manual operation and hence increasing the difficulty of meeting emergencies with sufficient celerity. In this equipment the changing of gears will be effected by the mere pressing of a button corresponding to each speed change, the arrangement in one car consisting of a circle above the steering wheel containing buttons for each of the three forward speeds, with one for the reverse and one for the neutral. On this arc are also placed buttons operating the electric self-starting apparatus and the electric horn of the machine. With the electrical gear shift the operation of the car requires a greatly reduced amount of laborious manipulation which can only be appreciated by the experienced driver, and the now well-standardized electric starting equipment needs no emphasis as a valuable feature of an up-to-date gasoline automobile. In the field of car lighting further departure is anticipated from the lamp locations common to the days of oil and acetylene, and a notable recent improvement consists in the replacement of rattling and cumbersome side lamps with bull's-eyes. In one instance the head-lamps have been incorporated in the front of the wheel guards. Experiments are understood to be in progress in the field of electrically operated brakes, and the whole trend of development tends to confirm a prediction not long since made that in time the only function of the gasoline engine will be to drive a generator equipment supplying electricity for all features of car control and operation.

Electrical Properties Have Successful Year.—Financial statements of seven electrical properties controlled by the Electric Bond & Share Company, of New York, for the year ended May 31 show an average increase in net earnings of 14.7 per cent over figures for 1912. Gross earnings for the seven companies averaged for that period 14.8 per cent higher than for 1912. The companies embraced in the above statement are the Southwestern Utilities Corporation, Canton Electric Company, Marion Light & Heating Company, Muncie Electric Light Company, Rockford Electric Company, Scranton Electric Company and Wheeling Electric Company. Excluding the first-named, on which figures are not available, the average increase for these companies in surplus after deduction of charges is 19.3 per cent over the figures on the same item for 1912.

Recent Installations of Dead-Front Switchboards.—Dead-front switchboards for stage and auditorium lighting control have been supplied by the Worcester Electric & Manufacturing Company for installation in the William Fox Theater and Roof Garden, at Ninety-seventh Street and Broadway and in the Boulevard Theater, Westchester Avenue and Southern Boulevard, New York. At the former two boards were supplied, one for the theater proper and one for the roof garden. Each measures 11 ft. by 6½ ft. and carries between fifty-five and sixty switches and dimmer attachment. The board at the second-mentioned location is 7 ft. by 6½ ft. in size and carries thirty or thirty-five switches and dimmer. The installation work in each case was done by the Haskell Electrical Contracting Company, of New York.

Foreign Inquiry for Federal Products.—Mr. W. W. Beachboard, of the Philadelphia office of the Federal Sign System (Electric), has sailed for a European journey to last three months. He will visit London, Paris, Berlin, Bologna and other cities in the interest of Federal products. The Federal porcelain-enamel steel sectional signs are gaining popularity abroad to such an extent that the company feels justified in sending a representative across the water.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	June 18	June 25
Allis-Chalmers, t.r., 5th pd	$19,800,000	.....	.....	7¼*	7¼
Allis-Chal., pf.,t.r.,5th pd..	16,050,000	.....	.....	13½*	14
Amalgamated Copper.....	153,887,900	1½	Q	66¼	64⅜
American Tel. & Tel.....	344,471,400	2	Q	128	128½
Electric Storage Battery,c.	16,074,425	1	Q	47½	45½
General Electric.....	101,363,600	2	Q	136*	137½
Mackay Cos., c.....	41,380,400	1½	Q	88*	83
Mackay Cos., pf.....	50,000,000	1	Q	69½*	68
Western Union Tel.....	99,747,600	¾	Q	63*	61½
Westinghouse, E. & M., c.	34,496,400	1	Q	60	60
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	109½*	109

*Last price quoted.

NEW YORK METAL MARKET PRICES

	June 17 Bid.	June 17 Asked.	June 24 Bid.	June 24 Asked.
Copper:				
Standard, spot	14.00	to 14.50	13.62½	.....
	£ s d		£ s d	
London, standard, spot	64 17 6		63 15 0	
Prime Lake	15.00	to 15.25	....	14.75
Electrolytic	14.87½	to 15.00	.....	14.50
Casting	13.75	.....	.....	14.37½
Copper wire, base	16.00	to 16.25	15.75	to 16.00
Lead		4.35		4.35
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f. o. b. smelter	.....	7.25		7.25
Spelter, spot	5 00	to 5.15	5.15	to 5.20
Tin, spot	44.25	to 44.75	43.25	to 43.75
Aluminum:				
Prompt delivery	25.00	to 25.50	23.50	to 24.50
Future	25.00	to 25.50	22.00	to 23.00

OLD METALS

Heavy copper and wire	13.50	13.50
Brass, heavy	9.00	8.75
Brass, light	7.87½	7.75
Lead, heavy	4.25	4.25
Zinc, scrap	4.12½	4.12½

COPPER EXPORTS

Total tons to June 24 22,465

Personal

Mr. Frank E. Filer has been appointed manager of the Winnipeg (Man.) office of the Packard Electric Company.

Mr. S. G. Retue has been appointed general superintendent of the Northumberland County Gas & Electric Company, with headquarters at Sunbury, Pa.

Mr. J. B. Harvey, manager of the Aurora (Neb.) Electric Company, has been appointed manager of the York (Neb.) Gas & Electric Company as successor to Mr. Pfeffer.

Mr. Edward Hendry has been appointed superintendent of the municipal electric-lighting system and waterworks at Wilmot, S. D., succeeding Mr. H. J. Christianson.

Mr. Charles Pfeffer has resigned as manager of the York (Neb.) Gas & Electric Company. He, however, retains his interest in the utility as chairman of the board of directors.

Mr. R. Niver has been appointed superintendent of the electrical department with supervision of power plants and electrical distribution of the City Light & Traction Company of Sedalia, Mo.

Prof. Alexander Graham Bell received the honorary degree of Doctor of Laws from Dartmouth College at its one hundred and forty-first commencement in recognition of his invention of the telephone.

Mr. W. D. Weaver has been elected a member of the Chamber of Commerce, Charlottesville, Va., and appointed a member of the committee on transportation and vice-chairman of the committee on electric lighting.

Dr. A. E. Kennelly, professor of electrical engineering, Harvard University, sailed on the Hamburg-American S.S. *Blücher* from Boston for Plymouth on June 24. Dr. Kennelly will remain abroad for about two months.

Mr. H. O. Edward, for the past twelve years advertising manager of the Canadian General Electric Company, Ltd., and its subsidiary companies, has resigned to become sales manager of the Photo Engravers, Ltd., of Toronto.

Mr. Hartwell Jolonick, new-business engineer of the Texas Power & Light Company, Dallas, Tex., has been transferred to the Brownwood (Tex.) Gas & Electric Company, which is controlled by the Texas Power & Light Company.

Mr. P. A. Rothwell has been appointed secretary, treasurer and manager of the Buffalo Manufacturing Company, which supplies electric service in Buffalo, Wyo. Mr. H. P. Rothwell, formerly secretary and treasurer, has been made vice-president of the company.

Mr. J. T. Young, president and general manager of the Muskegon (Mich.) Traction & Lighting Company, has been appointed manager of the Grand Rapids (Mich.) Gas Light Company, which is also one of the properties of the American Light & Traction Company.

Dr. J. B. Whitehead, formerly professor of applied electricity in Johns Hopkins University, has been appointed head of the department of electrical engineering in the new School of Technology of the university. Dr. Whitehead is a fellow of the American Institute of Electrical Engineers.

Mr. John S. MacLean, formerly in charge of the publicity and advertising work of Allis-Chalmers-Bullock, Ltd., of Montreal, has been appointed to a similar position with the Canadian General Electric Company and the Canadian Allis-Chalmers Company, Ltd., with headquarters in Toronto.

Prof. George W. Lamke, of Washington University, St. Louis, Mo., has resigned his position as assistant professor of electrical engineering to take a position in the advertising department of the Wagner Electric Manufacturing Company, St. Louis, Mo. Prof. Lamke is a member of the American Institute of Electrical Engineers.

Mr. H. Chamberlain, for many years superintendent, chief engineer and electrician of the Weatherly (Pa.) municipal electric-light plant, has resigned in order to accept the post of superintendent of the plant of the Harwood Electric Light Company at Freeland, Pa. Mr. C. Ketcham has been appointed successor to Mr. Chamberlain at Weatherly.

Mr. J. C. McPherson has resigned as superintendent of the northern division of the Pacific Electric Railway Company to become general manager of the Southern Pacific's electric lines in Alameda, Oakland and Berkeley, with headquarters in Oakland. This resignation of Mr. McPherson terminates a service of twenty-two years with the Pacific Electric.

Mr. E. H. Haughton, of Chicago, general manager of the Bryan-Marsh Works of the General Electric Company, sailed for Europe on July 1 on the steamship *Hamburg,* of the Hamburg-American line. He was accompanied by his father-in-law, Judge Malcom Yeaman, of Henderson, Ky. The two will make their first stop at Gibraltar, after which they will visit capital cities and places of historical and scenic interest. They will return about Sept. 1.

Mr. William B. McKinley, president of the Illinois Traction System, Peoria, Ill., was the guest of honor at a "goodwill" dinner tendered to him at the Illini Country Club at Springfield, Ill., recently by business and professional men of the latter city. Mr. McKinley has been elected president of the Oskaloosa Traction & Light Company and the Oskaloosa & Buxton Electric Railway, Oskaloosa, Ia., which were taken over on June 1, 1913, by him and his associates.

Mr. David Barker Rushmore, who was elected a member of the executive committee of the Hydroelectric and Transmission Section of the National Electric Light Association at its recent convention in Chicago, is widely known among electrical engineers. He was born in Old Westbury, N. Y., Aug. 21, 1873, and was graduated from Swarthmore College in 1894 with the degree of B. S. Three years afterward he received the degree of C. E. He spent a year at Sibley College, Cornell University, after leaving Swarthmore, specializing in electrical engineering, and received the degree of M. E. from that institution in 1895. Mr. Rushmore spent two years in testing and inspection work in the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company and in 1897 went to Montreal with the Royal Electric Company, at that time the Canadian branch of the Stanley Electric Manufacturing Company, Pittsfield, Mass. He subsequently joined the staff of the Stanley company and remained at Pittsfield from 1899 to 1905. Since that time he has been chief engineer of the power and mining department of the General Electric Company. Mr. Rushmore has contributed to the proceedings of many scientific bodies and has served on many committees in national engineering societies. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Society of Mining Engineers, the American Electrochemical Society, the American Mining Congress and the Engineers' Club, New York.

D. B. Rushmore

Obituary

Mr. Wilbur F. Davidson, of the Port Huron (Mich.) Light & Power Company, died at his home in that city on June 18. Mr. Davidson was a pioneer in central-station installation and operation in the State of Michigan and built the first electric plant ever installed in Port Huron. He was the father of Mr. James E. Davidson, at present vice-president and general manager of the Pacific Power & Light Company of Portland, Ore., and well known in electrical engineering circles on both the Atlantic and Pacific coasts, having been formerly connected with the Consolidated Lighting Company of Montpelier, Vt., and being a past-president of the Northwest Electrical Association and the New England Section of the N. E. L. A. and secretary and treasurer of the Michigan Electrical Association.

Construction

New England

CHICOPEE, MASS.—The transmission line from the Amherst Pwr. Co.'s plant at Amherst to Chicopee, which is to supply 1500 kw to the latter city, is almost completed. It is rumored that the Amherst company has offered to take the city's lighting plant off the hands of the municipality.

WESTFIELD, MASS.—The members of the municipal light board have had another conference with the Amherst Pwr. Co. in regard to the contract by which it is proposed to sell electricity to the local board. The board looks favorably upon the plan, and at a forthcoming public meeting the citizens will be asked to vote upon it.

WEYMOUTH, MASS.—The town lighting committee has decided to install 100 additional street lamps throughout the town.

WILLIAMSTOWN, MASS.—The Williamstown Gas Co. is contemplating extending its electrical service to South Williamstown.

MONTVILLE, CONN.—The Connecticut Pwr. Co., through the New London Gas & El. Co. division, is extending its wires from Montville to Kitemaug. The company also contemplates an extension to Palmerstown in the near future.

NAUGATUCK, CONN.—The changes recently approved by the Board of Wardens and Burgesses which called for the better illumination of the town are now being made by the United Elec. Lt. & Wtr. Co. F. J. Lyon is superintendent.

Middle Atlantic

BUFFALO, N. Y.—The Cataract Pwr. & Conduit Co. is to erect an addition to the power house at Front Avenue and Niagara Street at a cost of approximately $20,000.

MANASQUAN, N. Y.—After inspecting the lighting plants at Allentown and Lawrenceville, Mayor W. F. Lefferson and several councilmen of Manasquan favored the establishment of a municipal lighting plant in conjunction with the water system.

NEWBURGH, N. Y.—The Central Hudson Gas & El. Co., of Newburgh, has submitted a proposition to the Water Commissioners to furnish electricity to operate the pumping station of the water-works system. At present the station is operated by steam-power.

NIAGARA FALLS, N. Y.—Falls Street from the State Park at Riverway to Fourth Street will be illuminated in a decorative manner. The poles will be about 70 ft. apart, and suspended from each pole, at a distance of 4 ft., will be magnetite inverted luminous arc lamps. The illumination will cost $13,000. Maintenance cost will be met by the city and the power company will supply the power.

SYRACUSE, N. Y.—The ornamental street-lighting committee of the Chamber of Commerce has filed with the Mayor a revised plan for the extension of the ornamental lighting system.

SYRACUSE, N. Y.—Improvements will be made to the power plant of the Syracuse Ltg. Co., to cost about $100,000, to provide an emergency service in case of failure of the service of the Niagara, Lockport & Ontario Pwr. Co. The new equipment will include a 7500-hp steam turbine and generator.

HONESDALE, PA.—The Wayne County Ry. Co., recently incorporated, plans to build a 15-mile electric line. M. B. Allen is interested.

INTERCOURSE, PA.—The Intercourse El. Lt., Ht. & Pwr. Co. has purchased the equipment for the installation of 150 kva. There is no day service at present, but connections will shortly be made with the Edison El. Co. of Lancaster and 24-hour service given. There is a promising outlook for a motor load. Enos L. Zimmerman is secretary and treasurer of the Intercourse company. J. E. Kershner, of Lancaster, Pa., and John L. Livers, of Charlottesville, Va., are also interested in the new project.

NICETOWN, PA.—It is reported that the G. W. Blabon Co. is to erect a power plant at this place at a cost of $20,000.

PHILADELPHIA, PA.—Plans are being prepared by the Philadelphia Rapid Transit Co. for the construction of a new substation (96 ft. by 54 ft.) at its Thirteenth Street and Miffin Street carhouse.

PHILADELPHIA, PA.—The Electrical Bureau has enlisted the aid of Mayor Blankenburg for a plan to have the city's wires gradually placed underground and to replace many of the old poles now carrying wires overhead. The department is making an early start to obtain the appropriation from the 1914 budget. It is proposed to construct underground conduits at the rate of 10 miles per annum. The system is to begin at City Hall.

BURLINGTON, N. J.—The Public Service Corporation (Newark) is negotiating for property on the Delaware River and plans the erection of a power station, which is later to supplant the company's stations at Burlington, Bordentown and Cinnamonson.

FARMINGDALE, N. J.—The Board of Public Utilities Commissioners has given its approval of an ordinance of the Board of Freeholders of Monmouth County granting the Farmingdale Ltg. Co. permission to operate its system on the road between Freehold and Farmingdale.

HOLMDEL, N. J.—The Middlesex & Monmouth El. Lt., Ht. & Pwr. Co. is extending its system to this place. Ten lamps have been ordered placed on the roads at an annual cost of $30 per lamp.

SHEPHERDSTOWN, W. VA.—Major Randolph Stalnaker has purchased the plant of the Shepherdstown El. Lt. & Pwr. Co., formerly owned by John L. Livers and others.

WASHINGTON, D. C.—Sealed proposals will be received at the Treasury Department until 3 P. M., July 21, for the construction, complete, including electric conduits and wiring and interior lighting, of the United States Post Office at Cartersville, Ga. O. Wenderoth, supervising architect.

North Central

CASSOPOLIS, MICH.—An ornamental lighting system for the downtown district is under consideration here.

DETROIT, MICH.—The residents of Rhode Island Avenue, Highland Park, have petitioned the Village Council for the installation of five-lamp clusters on street corners in place of arc lamps, offering to defray the additional cost. The Council is favorably considering the plan for beautifying this section of the suburban district.

DUNDEE, MICH.—N. D. Carpenter, Detroit, Mich., is reported to have purchased the electric-light plant, with the idea of improving and operating it. It now has a capacity of 300 hp.

ONSTED, MICH.—Plans are being considered for the installation of an electric-light system here. W. F. Morrill is interested in the project.

ROSCOMMON, MICH.—Since the destruction by fire of the municipal electric-light plant the Village Council is investigating water-power possibilities before taking further action in regard to establishing a new plant. Should the plan prove feasible, Council will order special election to bond village for necessary funds. G. S. Casson, city clerk.

ARCHBOLD, OHIO.—The Archbold El. Lt. & Pwr. Co. expects to install a new street-lighting system in the business section, but has not yet decided whether to use flaming-arc lamps or tungsten lamps erected on standards. The company has recently installed a storage battery to take care of the day load. R. Rodenhus is manager.

LIMA, OHIO.—The Board of County Commissioners is contemplating a number of improvements to the County Infirmary, among which will be the installation of an electric-light and power plant, a chapel and hospital.

WARREN, OHIO.—The Trumbull Public Service Co. is planning to expend $40,000 for improvements to its plant.

LOUISVILLE, KY.—A. L. Kaercher Furniture Co. will require a number of motors in the equipment of its factory.

LOUISVILLE, KY.—The Board of Park Commissioners is considering the advisability of replacing the acetylene lamps on the parkways by a system of electric lighting. Representatives of the Louisville Ltg. Co. are advising with the commissioners on this subject.

PADUCAH, KY.—The City Council is considering appropriating $9,000 for the equipment of a new pumping station, in which the pumps will be motor-driven. L. A. Washington, city engineer.

SPICELAND, IND.—George Otis Spencer, of this place, has been given legal notice by the Town Council of its acceptance of his proposition to install an electric-lighting plant here. Mr. Spencer is to install and maintain at least 60 60-cp incandescent lamps, for which the town will pay $20 per annum each. The contract is for 10 years.

ALEDO, ILL.—The Tri-County Lt. & Pwr. Co. contemplates improvements involving an expenditure of $300,000. A network of lines will cary electricity to all the surounding towns for use by farmers for light and power. Fifty-four five-lamp clusters for street lighting have just been installed. Adolph A. Barton is general superintendent.

BELVIDERE, ILL.—The building committee of the Boone County Board of Supervisors has awarded to Greenlee & Wilson the contract for electric wiring and fixtures for the county almshouse, including two gasoline engines.

BLOOMINGTON, ILL.—A movement has begun for the installation of ornamental lamps on Monroe Street between Center and Madison Streets, on Madison Street between Monroe and Jefferson Streets, and on Jefferson Street between Center and Madison Streets. E. Sellman is interested.

CAIRO, ILL.—During the next four months the Cairo Ry. & Lt. System will be in the market for wire and meters. M. C. Whiting is superintendent of the electrical department.

CARLINVILLE, ILL.—The City Council has voted to change the street-lighting system and use 250-watt tungsten lamps. The McKinley company, which has the contract to supply energy for street lighting, will make a rate of $5 a lamp a year.

CHICAGO, ILL.—Bids will be received until July 1 by L. E. McGann, commissioner of public works, for furnishing and delivering a 275-kva single-phase transformer at the Twenty-second Street pumping station, 2260 South Ashland Avenue.

CLAYTON, ILL.—During the next six months the Central Illinois Public Service Co. expects to erect a substation, transformer tower and transmission lines to replace the local plant. The company expects to purchase within the next few months switchboards, instruments, switches and arresters to replace those now in use. The entire distribution

system will be rebuilt within the next two months. Very shortly a constant-current regulator will be purchased and sixty 32-cp tungsten lamps will be installed. A new supply of electrical appliances and supplies will be included among the new purchases to be made within the next half year. E. B. Doocy is local superintendent at Clayton.

JACKSONVILLE, ILL.—The city clerk has been authorized to advertise for bids for a 200-kw, three-phase, 60-cycle, 2300-volt revolving-field generator.

LENA, ILL.—During the next few months the Lena El. Lt. & Pwr. Co. expects to erect a 7-mile transmission line to Pearl City, for which the company has a 30-year franchise. It has also secured the street-lighting contract for 10 years. Within the next thirty days one three-phase 75-kva to 100-kva, 60-cycle generator will be purchased. G. W. Benfer is manager.

LEXINGTON, ILL.—The Bloomington & Normal Ry. & Lt. Co., of Bloomington, is planning to make a number of improvements to the local plant, recently purchased from the Lexington El. Lt. Co. A transmission line will be erected from Chenoa to connect Lexington with the Bloomington plant.

MASCOUTAH, ILL.—The Mascoutah El. Lt. Co. has been purchased by the city of Mascoutah, and the water-works and electric-light plant are now under municipal control. Carl Montag, Mayor.

MORRISON, ILL.—The City Council has granted a 25-year franchise to the Rock River Lt. & Pwr. Co. to operate an electric-lighting system here. The rates may be revised at the end of each five-year period. The city may purchase the company's interest in Morrison at the expiration of any five-year period. The city is given 100,000 watt-hours of energy a month to be used in lighting the city buildings.

PARIS, ILL.—The City Council has voted to appoint a committee, consisting of the Mayor, city attorney, an engineer and three citizens, to make an investigation and secure estimates of the cost of supplying electricity for the municipal water-works system.

PEARL CITY, ILL.—The Village Board has granted a franchise to the Lena El. Lt. & Pwr. Co. to sell energy for lighting and motor service in the city. The board has also awarded a contract for lighting the streets for $900 per annum, for which a transmission line will be built from Lena to Pearl City. Thirty 100-cp tungsten lamps will be used.

PITTSFIELD, ILL.—The City Council and the Central Illinois Public Service Co. of Mattoon, Ill., are said to have reached an agreement whereby a reduction in rates for motor service will be made and the Council will grant a franchise to the company.

HANCOCK, WIS.—The new electric-light plant at this place is almost ready for service. W. H. Burwell is the consulting engineer and superintendent of the work.

SHAFANO, WIS.—We are informed that the City Wtr. & Lt. Plant expects to erect within the next three or four months a new brick stack about 60 in. in diameter and 90 ft. high. The plant has recently purchased one 15-kva constant-current series arc lamp regulator. Equipment to be purchased shortly includes one 10-amp ammeter, one 13,000-volt instrument transformer and about six 5-amp, 110-volt, 60-cycle watt hour meters and one horn-type lightning arrester. Paul E. Capraso is superintendent.

SOLDIER'S GROVE, WIS.—Within the next two months the Soldier's Grove El. Co. expects to purchase 20 poles and 1750 ft. No. 0000 weather-proof wire. Thomas O. Sims is manager.

CROOKSTON, MINN.—Plans are under foot to install a lighting plant.

DULUTH, MINN.—Residents are earnestly urging the redistribution and the increase of the street lamps. Commissioner Leonidas Merritt, head of the division of public utilities, is having a thorough investigation made as to the needs of the city in this direction.

DULUTH, MINN.—The Great Northern Power Co. is reported to have filed an amendment to its articles of incorporation with the Secretary of State, increasing its capitalization from $2,500,000 to $11,000,000. It is understood that the power company which now supplies power for Duluth intends to extend its system.

FAIRMONT, MINN.—Plans are now being prepared for the enlargement and improvement of the municipal electric-lighting plant, which will be started this summer. It is the intention to purchase an additional 200-hp engine soon.

GRASSTOWN, MINN.—The Eastern Minnesota Pwr Co., Pine City, has been granted the privilege of erecting and maintaining poles, masts, wires and other fixtures at Grasstown for 25 years.

GREAT FALLS, MINN.—It is reported that $5,000,000 is to be spent in the erection of a new dam at this place.

LITCHFIELD, MINN.—The people will be given an opportunity to vote on the proposition to issue $7,500 electric light bonds. City clerk will give particulars.

ONAMIA, MINN.—At a special election held June 17 on the question of issuing bonds for the purpose of establishing a municipal electric-lighting plant, as mentioned last week, the proposition was vetoed, and the matter has been abandoned for a year. Henry Goulet, clerk.

PIPESTONE, MINN.—Plans are underfoot to improve greatly the lighting of the main street.

WARREN, MINN.—Consideration is being given to the proposition to enlarge the municipal lighting plant. W. Haney is superintendent.

WOOD LAKE, MINN.—The plans for the proposed municipal electric-lighting plant are not yet completed, but it is probable that F. Wherland, Redwood Falls, Minn., will have charge of the construction work when begun.

BELLEVUE, IA.—A boulevard lighting system is being discussed.

BURLINGTON, IA.—The wires of the electric light and power company at this place have been ordered placed underground in accordance with a recent ordinance.

CEDAR FALLS, IA.—At a meeting of the City Council June 9 the sale of $50,000 of light bonds recently authorized by the Council for the construction of a municipal plant, to which reference has been made in previous issues, was consummated when the bid of 5.5 per cent offered by the Geo. M. Bethel Co., of Davenport, was accepted. The Council will advertise for bids for the construction of the plant in the early part of July, and it is hoped that the plant will be in operation by Nov. 1. It is planned to make this one of the most up-to-date plants in the State. C. H. Streeter is engineer.

EARLY, IA.—By a vote of four to one the citizens of this place on June 12 decided to establish a municipal electric-lighting plant.

EAST PERU, IA.—It is proposed that an electric-lighting system will be installed here.

IOWA FALLS, IA.—A petition has been presented to the electric-light committee for installing lamps on poles along Main Street.

ONAWA, IA.—The City Council voted recently to have the municipal electric-lighting plant supply 24-hour service as soon as the plant can be put into condition for the additional demand for energy that will follow this change. The Council is in favor of installing a second unit in order to maintain uninterrupted service and provide for an emergency.

POMEROY, IA.—A special election has been called for July 15 to vote upon a bond issue of $15,000 for an electric-lighting system. The energy will be secured from Pocahontas.

AVA, MO.—Plans are being considered by J. B. Quigley, promoter of the Kansas City, Ozark & Southern Railroad, for the construction of a hydroelectric plant on Bryant River to supply electricity in Ava and to operate the railway between Ava and Mansfield. It is proposed to locate the dam near the South Douglass County line.

HANNIBAL, MO.—Committees from New London, Center, Perry and Frankford have recently conferred in Hannibal with a view to securing electric service. A transmission line may be built connecting with the distibuting station south of the city, or with the Hannibal municipal plant, or the cities may be served by the Mississippi River Pwr. Co. S. C. Gill, of Perry, and E. B. Marmaduke, of New London, are interested.

KEARNEY, MO.—It is reported that John A. Eby and T. Henderson have been granted a franchise for furnishing electric light.

LINN CREEK, MO.—The Niangua Heights Devel. Co. is planning to construct a dam for lake and develop water-power to generate electricity for lighting buildings, in connection with a resort on Osage River. H. G. Everett is president.

SENECA, MO.—An electric-lighting plant for this city is being planned. H. H. Mace, Mountain Grove, Mo., is interested.

BOWBELLS, N. D.—An electric-light plant is planned for this place. J. W. Bearden is interested.

LARIMORE, N. D.—Prominent citizens are interested in the establishment of a "white way" system.

COLEMAN, S. D.—Arrangements are being made by local business men to secure electrical service from the Flandreau Lt. & Pwr. Co., to be transmitted from the plant at Flandreau, to light the streets and buildings here.

HOWARD, S. D.—The Miner Co. Milling & Ltg. Co. expects to purchase a second unit, preferably steam, and the necessary switch for three-phase power circuit; also single-phase transformers to equip three-phase, 60-cycle power circuit at Howard and Canova. Current-consuming appliances and supplies as called for will also be purchased. C. A. Laurson is manager.

GERING, NEB.—Village Clerk T. S. Rubottom informs us that no electric-light plant is contemplated, as mentioned June 14. The city is supplied with energy by the Cross & Roberts El. Co., Scottsbluff.

GRAND ISLAND, NEB.—The City Council will receive sealed bids for furnishing 131 electroliers. H. E. Clifford, city clerk.

ASSARIA, KAN.—C. W. Lamer, of Salina, appeared before the City Council asking that the proposition to light Assaria from the plant at Lindborg be considered. A committee was appointed to investigate the matter. M. H. Blaine is superintendent of the municipal plant at Lindborg.

MANHATTAN, KAN.—A charter for the Kew Valley Transmission Co., capitalized at $15,000, will be applied for at once. The company plans to furnish electricity to St. George and Zeandale. It is reported that the company will furnish energy to farmers and others at a very low rate. W. Dalton, president.

MOLINE, KAN.—John W. Turner, city clerk, writes that bids will be received in July for the construction of an electric-light plant and water-works, from plans of the Benham Engineering Co., American National Bank Building, Oklahoma City, Okla.

TOPEKA, KAN.—Bids will be received until July 7, it is reported, by the city commission, for "white way" extensions on Eighth and Quincy Avenues and Seventh Street.

Southern States

ROCK HILL, N. C.—Electricity for the new pumping station here will be furnished by the Southern Pwr. Co., Charlotte, N. C.

RIDGELAND, S. C.—A vote will soon be taken on a bond issue to construct an electric-light plant and water-works here.

SPARTANBURG, S. C.—It is reported that the Southern Pwr. Co. will begin the construction of a substation near Saxon Mills to supply energy for the operation of the cars of the Greenville, Spartanburg & Anderson Ry. The company will install a 2000-hp plant, containing three transformers and two generators. Alternating current from the company's 100,000-volt transmission line will be changed to direct current at 750 volts. The plant is expected to be completed in the fall.

ADEL, GA.—The municipal electric-lighting plant, of which F. R. Sutton is superintendent, expects within the next six months to purchase one 4-kw, 120-volt exciter, a portable voltmeter and several 1-kw, 2300-110-volt transformers.

FORT GAINES, GA.—At an approximate cost of $10,500, one-half of which will be subscribed by local business men, it is planned to erect an electric-light plant on the Chemochechobee Creek, 1½ miles north of the town.

GRIFFIN, GA.—The Tonaliga Falls Pwr. Co. in the near future plans to buy one 1200-kw, 2300-volt, 60-cycle, three-phase generator and water wheel. Frank Mayes, superintendent.

LAVONIA, GA.—T. R. Knox informs us that the Shoals Creek Pwr. Co. has leased its plant for a period of twenty years to the J. B. McCrary Co., of Atlanta, Ga.

LAWRENCEVILLE, GA.—Within the next eight months the city expects to purchase apparatus for equipping one substation, to be used for transforming energy from 11,000 volts to 2300 volts for city lighting. The energy will be deliveed from Tallulah Falls and will be purchased from the North Georgia Pwr. Co. at 1½ cents per kw-hr. The price was formerly 5 cents. The plant is now owned by the J. B. McCrary Co. Edward Tarpley is city electrician.

SCOTT, GA.—T. J. Burke is planning to install an electric-light plant.

ALACHUA, FLA.—The Council is reported to have engaged the J. B. McCrary Co., of Atlanta, Ga., to prepare plans for an electric-light plant and water-works, to cost about $24,000.

MULBERRY, FLA.—The Mulberry El. Co. expects to purchase within the next two months tub transformers, street series fixtures, mast arms and other equipment. H. J. Pratt is superintendent.

ST. AUGUSTINE, FLA.—The lighting system of the St. John's Lt. & Pwr. Co. will be extended from St. Augustine to Chetauqua Beach, a distance of 6.5 miles, within the next two months, and superheaters installed on all boilers. T. P. Alston is general manager.

TALLAHASSEE, FLA.—The municipal water, gas and electric-light plant is reconstructing the entire distribution system. It has recently built new lines extending outward from the city for two or three miles, from which a profitable load is expected. Within a few months a new boiler will be bought.

HUNTSVILLE, ALA.—The engineers of the Alabama Pwr. Development Co., Talladega, Ala., have measured the quantity of water pumped for the city with a view to making a contract for running the pumps by electricity.

PERKINSTON, MISS.—An electric-light plant is being installed at the Agricultural High School, which will light the buildings of the school as well as the town and a number of residences. A system of water-works is also projected.

MARIANNA, ARK.—The property of the Marianna Lt., Ht. & Wtr. Co., including the street-car system, light and water plant, has been purchased by the Light & Devel Co., of St. Louis, Mo.

PLAINVIEW, ARK.—A company has been organized by local business men to install an electric-light plant in Plainview. Application will soon be made to the Council for a franchise. Electricity for operating the system will be supplied by the Fort Smith Lumber Co.

BASTROP, LA.—A complete renovation of the municipal electric-lighting plant and additions, which will involve an outlay of approximately $12,000, is contemplated for this plant. C. F. Lockwood is manager and chief engineer; J. K. Skipworth, Mayor.

BREAUX BRIDGE, LA.—The erection of an electric-light plant is being discussed.

COLORADO, TEX.—One 65-hp Rumley oil engine has recently been installed in the plant of the Colorado El. Lt. Co. R. M. Webb is secretary and treasurer.

TEMPLE, TEX.—Increased lighting of Nineteenth Street and Avenue H and Freeman Heights has been ordered.

WACO, TEX.—In the fire district at this place all the wires have been ordered placed underground at once.

WHITESBORO, TEX.—At a recent election it was voted to install a municipal electric-lighting plant.

WHITESBORO, TEX.—J. C. Jones, city secretary, informs us that the city has voted a bond issue of $6,000 with which to install an electric-light plant, to be run in connection with the city water-works. The contract will probably be let within the next sixty or ninety days.

Pacific States

CASHMERE, WASH.—The Town Council recently authorized the rebuilding of the present substation and pumping house. The rapid growth of the light and power system calls for a reconstruction of the distribution system. Contracts have been let for the installing of a tungsten series street-lighting system, to include 120 ornamental posts in the business section and principal residential streets. At the next meeting of the Town Council the kind of post to be used will be decided upon. O. M. Carter is superintendent of the water and light department.

COLVILLE, WASH.—The Little Pend Oreille Tel. Co., recently organized, will erect a telephone line from Colville to Pend Oreille, a distance of 27 miles. J. S. Gnagy is president.

SEATTLE, WASH.—Daniel Huntington, city architect, has completed plans for a four-story brick and concrete power plant to be erected at Richmond Heights, Seattle. Estimated cost, $20,000.

SPOKANE, WASH.—The Methow River Pwr. Co. is planning to extend its transmission line up the Okanogan River, from Brewster to Riverside, Wash., a distance of 30 miles. Nixon & Kimmel, electrical engineers, Spokane, have the contract.

SPOKANE, WASH.—The Okanogan Valley Pwr. & Lt. Co. has been organized and has taken over the power plants of the Nixon-Kimmel Co. (Spokane), the Big Bend Lt. & Pwr. Co. (Spokane) and the Grangeville (Idaho) Lt. & Pwr. Co. The systems will be combined and many improvements made. Eugene Enloe, Medical Lake, Idaho, is president.

AMITY, ORE.—Plans are being prepared for a complete water system, to consist of pumping station and distributing system and to cost about $25,000. Bids for construction will be called for after the sale of bonds has been completed.

ARLINGTON, ORE.—LePage, McKenny & Company, Yesler Way, Seattle, Wash., will be awarded the contract for furnishing all materials and constructing an electric-lighting plant and pumping station for the city of Arlington. Louis C. Kelsey, Selling Building, Portland, Ore., is engineer.

EASTSIDE, ORE.—Application for a franchise for the establishment of an electric-light and water system has been made by E. C. Drews, manager Coos Bay Home Tel. Co.

MEDFORD, ORE.—The State Railroad Commission of California has granted the California-Oregon Pwr. Co., of Medford, permission to purchase the electric light and power plant of R. E. Cavanaugh at Edgewood, Cal., for $10,000, and the electric plant in Sisson, Cal., owned by George H. Johnson, for $15,000, both in Siskiyou County.

BERKELEY, CAL.—The Newberry Bendheim El. Co. has been awarded the contract for the construction of five-lamp electroliers on University Avenue, from Shattuck Avenue to Grove Street, for $75 per electrolier. The Joshua Hendy Co. received the contract for three-lamp electroliers on University Avenue for $408.

BURBANK, CAL.—It is reported that plans are now being discussed for supplying electrical energy for lighting and domestic purposes by the municipal lighting plant at Glendale, of which H. B. Lynch is manager.

CASA VERDUGO (NORTH GLENDALE), CAL.—Negotiations are now in progress to form a lighting district to be served by the municipal lighting plant at Glendale, which for several years has furnished energy for domestic purposes. Casa Verdugo now wishes its streets lighted from the same source.

ELSINORE, CAL.—The board of trustees has approved the plan urged by prominent citizens of placing ornamental street lamps on Main Street and extending the city lighting system. It is estimated that 19 reinforced-concrete poles, supporting a cluster of 60-watt tungsten lamps, would cost between $350 and $400.

FONTANA, CAL.—A new town site was opened at this place on June 7. Improvements under way include a modern electric-light plant.

GARDENA, CAL.—The State Railroad Commission has granted the Southern California Edison Co. permission to purchase the local electric-light plant, owned by the Pacific El. Ry. Co., at $17,500.

HOLLISTER, CAL.—Dr. H. J. Macomber has signed a contract with the Coast Counties Gas & El. Co. for the extension of its lines from Hollister to Paicines.

PASADENA, CAL.—The Pacific El. Ry. Co. is planning to spend $300,000 in additions and improvements in the city of Pasadena. Included in this work is the double-tracking of the line on Lake Avenue between Colorado and Washington Streets.

PIEDMONT, CAL.—Consideration is being given to the proposition to install a municipal electric-lighting plant.

RICHMOND, CAL.—The lines of the Great Western Pwr. Co. will be extended at once into Richmond. Rust, San Pablo, Pinole and Rodeo, the company having recently been granted a franchise by the county supervisors. It is reported that the company proposes to build over 159 miles of new lines, at a cost of $200,000 in Contra Costa County.

SACRAMENTO, CAL.—The State Railroad Commission has granted permission to the Northern El. Ry. Co. to build and operate electric lines in Sacramento. Work is to begin at once on these lines to give a route to the company's through lines into the business section of Sacramento.

SAN DIEGO, CAL.—The San Diego Gas & El. Co. plans to spend $459,000 for extensions and improvements.

SAN DIEGO, CAL.—Plans and specifications are being prepared by the city engineer for an ornamental lighting system to be installed on various streets of San Diego.

SUSANVILLE, CAL.—The Lassen El. Co. has applied to the State Railroad Commission for permission to purchase the Branhan power plant for $4,500.

VENICE, CAL.—The Southern California Edison Co. has been awarded the contract at $17,738 for furnishing and installing a complete lighting system in the city of Venice.

YUBA CITY, CAL.—The Great Western Pwr. Co. has obtained a franchise from the Board of Supervisors of Sutter County to build and operate distribution systems and transmission lines within the county. The company expects to enter the local field immediately.

MOUNTAIN HOME, IDAHO.—The construction of a 30,000-acre irrigation system has been completed by the Crane Falls Pwr. & Irrigation Co. The water is being lifted 175 ft., 100 ft. and 65 ft. by pumps requiring 6000 hp.

BILLINGS, MONT.—Plans are being prepared for the construction of an electric railway from Billings to Yellowstone National Park.

BUTTE, MONT.—During the next fortnight a petition will be sent to the City Council asking the city to extend the luminous arc-lighting system to the whole of the business district. It is proposed to use only the 6.6-amp luminous-arc lamps. Because of the large number of lamps employed the cost of installation will be less than in the original district. The initial lamps cost $2.05 per front-foot; the new installation will cost $1.25 per front-foot and 75 cents per front-foot per year for maintenance. The Council favors the plan, which has also the indorsement of the city administration.

GLASGOW, MONT.—During the next six months the municipal electric-lighting plant expects to purchase a surface condenser large enough to handle one 10-in. by 18-in. by 14-in. tandem compound pump, 100 lb. pressure; one 75-kw turbine unit and two 9-in. by 14-in. by 12-in. by 8½-in. duplicate tandem compound pumps working against a pressure of 80 lb. The city plant will also purchase all kinds of heating and cooking devices. Within a year or so the plant will have need for one 75-kw, 2300-volt, three-phase, 60-cycle steam turbine unit. A. J. Melvin, city electrician.

GREAT FALLS, MONT.—The Great Falls Pwr. Co. is constructing a hydroelectric power plant at the higher falls on the Missouri River about 6 miles from Great Falls. Six main generating units will be installed for the development of 60,000 kw. A dam 1200 ft. long and 75 ft. high will be constructed.

HELENA, MONT.—No action has as yet been taken in regard to the proposed installation of 350 ornamental lamp-posts in the West Side district. The estimated cost is 0.6 cent per square foot of property. Decision has also been reserved in regard to lighting the Fourth Ward district, where 216 ornamental posts are to be installed at some future date.

LEWISTON, MONT.—The Lewiston El. & Pwr. Co. proposes to build its local distribution system and to rebuild the flume leading from headquarters at Spring Creek to the power plant. This work entails an expenditure of $25,000.

THOMPSON, MONT.—The Thompson Falls Power Company is constructing a hydroelectric plant on Clark's Fork of the Columbia River at Thompson. A concrete dam, 1200 ft. long and 55 ft. high, will be constructed and six generating units, for developing 30,000 kw, will be installed. Transmission lines will eventually be extended from this plant into the Coeur d'Alène (Idaho) mining district.

LARAMIE, WYO.—Within a few weeks the Laramie El. Co. expects to purchase a synchronous motor, complete with panel and power-factor indicator, for driving a direct-current system. A. E. Anderson is superintendent.

THERMOPOLIS, WYO.—In the fall or later the Hot Springs Lt. & Pwr. Co. expects to purchase three carloads of poles and 260 cross-arms. M. W. Thompson is manager.

FORT LUPTON, COL.—A contract has been entered into between the municipality and the Fort Lupton Lt. & Pwr. Co. for pumping water into the city. A 50-hp motor will be used to drive a 5-in. by 10-in. triplex Rumley pump. O. F. Nats is local manager.

MILLIKEN, COL.—The Milliken Lt. & Pwr. Co. has been purchased by and is now incorporated with the Fort Lupton Lt. & Pwr. Co. under the latter name.

MONTROSE, COL.—The Montrose El. Lt. & Pwr. Co. has been purchased from the Federal Lt. & Trac. Co. by the owners of the Ouray El. Lt. & Pwr. Co., E. A. Phinney is president of the company at Ouray and at Montrose. C. L. Flower is manager. The company proposes during the next nine months to erect a 55-mile transmission line from Ouray through Montrose to Delta, for which equipment and supplies will be needed.

ORDWAY, COL.—The Ordway El. Lt. & Pwr. Co. has just completed a new substation for local distribution in Sugar City. Energy is purchased from the Arkansas Valley Ry., Lt. & Pwr. Co. and is transmitted at 13,000 volts from Rocky Ford. Twenty-four-hour service will be maintained. M. S. Slaughter is manager at Ordway.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co. expects to erect within the next three months 12 miles of 13,000-volt transmission line, extending from Pueblo to Vineland and Devine, Col. W. F. Raber, Pueblo, is manager.

YERINGTON, NEV.—Work has begun on the 22-mile transmission line of the Truckee River Gen. El. Co. between the Bluestone substation and the mining camp at Pine Grove.

SANTA FE, N. M.—It is reported that a syndicate of Chicago men has taken over the projected White Rock Canyon hydroelectric project which was being promoted by Charles M. Lang, of Salt Lake City, and associates. It is planned to build a dam across the White Rock Canyon and construct a large hydroelectric plant. A system of power transmission lines will also be built, running to Albuquerque, Santa Fé, Las Vegas and other places.

Canada

SOUTH VANCOUVER, B. C.—L. F. Rawden, municipal electrician, has been instructed by the fire, water and light committee of the City Council to prepare an estimate of the cost of constructing an electric-light plant for supplying incandescent lighting and motor service for residents and factories.

VANCOUVER, B. C.—The big dam across the Okanogan River north of Wenatchee and the power house for the Cascade division of the Great Northern Railway, between Seattle and Spokane, has just been completed. Over 50,000 hp will be developed. The electrification of the Cascade division, it is expected, will be completed within a year. Guthrie, McDougall & Co. are the engineers.

VANCOUVER, B. C.—R. F. Hayward, general manager of the Western Canada Pwr. Co., Ltd., informs us that the improvements being made at present include extensions to the power house to accommodate two additional 8850-kw units and the raising of the dams 25 ft. above their present elevation to increase the storage capacity of Stave Lake. The contract for the two 13,000-hp turbines has been let to Escher, Wyss & Co., of Switzerland. The contract for the two new generators has been let to the Canadian Gen. El. Co. The Canadian Westinghouse Co., which provided the initial switchboard, has secured the contract for the extension of the same. The whole plant, it is expected, will be completed during the summer of next year, and during the following year the company expects to commence work on the development of the second plant, which will have an ultimate rating of 35,000 kw and will involve the construction of a dam 150 ft. high in a narrow rock gorge.

VERNON, B. C.—The City Corporation is spending $85,000 on its generating, lighting and distributing system, $50,000 for an additional oil engine and generator and $8,000 for ornamental street lighting.

RUSSELL, MAN.—A by-law has been passed to expend $18,000 on an electric-lighting plant.

ST. JOHN, N. B.—The W. O'Leary Co., of Montreal, Can., has been awarded the contract for the installation of an electric lighting system in the Cathedral of the Immaculate Conception.

BRIDGEBURG, ONT.—The Bridgeburg Manufacturers' Association has decided to ask the Ontario Pwr. Co., of Niagara Falls, to extend its transmission lines to Bridgeburg.

GALT, ONT.—The residents of Ainslie Street have petitioned the Hydroelectric Department of the city for the installation of ornamental lamp standards, carrying three-lamp clusters, on Ainslee Street from Colborne Street to Concession Street.

ORILLIA, ONT.—City Electrician W. K. Greenwood has submitted a report of the cost of installing five-lamp ornamental standards on both sides of the main street—one estimate for overhead and another for underground service wires.

ST. THOMAS, ONT.—The St. Thomas Biscuit Co. will install motors aggregating 150 hp and will require all auxiliary equipment.

STOUFFVILLE, ONT.—A resolution has been adopted by the Council requesting the Hydro-Electric Power Commission to extend its lines to Stouffville to furnish electricity.

SUNDERLAND, ONT.—The expenditure of $5,800 has been authorized for the establishment of a hydroelectric plant.

TORONTO, ONT.—The Hydro-Electric Power Commission of Ontario has granted the application of the Union Carbine Co., of Welland, for the supply of 16,000 hp. The Union company is constructing a plant at an approximate cost of $750,000.

TWEED, ONT.—The Tweed El. Lt. & Pwr. Co., which has been purchasing its energy from the Seymour Pwr. & El. Co., has been authorized by the village of Tweed to erect a plant and supply energy for light and power in the village. The household lighting rate is to be 9 cents per kw-hr. The street lighting calls for fifty 40-watt and forty 60-watt tungsten lamps, for which a yearly rate of $970 will be paid.

WELLAND, ONT.—Arrangements are being made for placing underground all the telephone, telegraph and electric-light wires on Main Street, at a cost of $20,000.

WINGHAM, ONT.—The Town Council has passed a by-law authorizing the purchase of additional equipment for the municipal electric-light plant at a cost of $8,500.

HULL, QUE.—The Hull Pwr. Co. contemplates the construction of a new power house and installation of new equipment, to cost about $1,500,000.

HULL, QUE.—The Ottawa & Hull Pwr. & Mfg. Co. is to build a station at Hull to supply electricity for motor service. Equipment to be purchased includes two 9500-hp waterwheel governors and two 7650-kw, 12,000-volt generators. Wm. Kennedy, Jr., Montreal, Que., is the engineer in charge of the work. Hon. W. C. Edwards, Ottawa, is president; R. Blackburn, Ottawa, is secretary-treasurer.

ST. ROSE, QUE.—Bids will be received until July 7, it is reported by J. A. Ely, secretary-treasurer, for constructing a water tank, sewage-purification system, filtration plant, pumps and power house for the water-works system. Plans and specifications may be obtained from Ouimet & Lesage, Montreal, Can.

SOREL, QUE.—The City Council has under consideration the installation of an electric fire-alarm system.

PRINCE ALBERT, SASK.—Plans and specifications are being prepared for a modern steam generating station, prime movers to be condensing steam turbines connected to 2000-kw alternators; 5000-hp water-tube boilers with mechanical stokers, and coal-handling machinery. R. Wright, electrical superintendent.

SASKATOON, SASK.—An expenditure of $15,000 is planned for the extension of the electric light and power system. Andrew Leslie, city clerk.

YORKTON, SASK.—A by-law was submitted to the electors on June 20 authorizing the expenditure of $140,000 for extending the present plant of the town and for distribution for light, heat and power purposes.

New Industrial Companies

HERRICK AIKEN & COMPANY, of Lawrence, Mass., has been incorporated with a capital stock of $100,000 by Herrick Aiken, Arthur L. Fulkerson and Walter J. Keating. The company proposes to do a general electrical business.

THE DAYTON-DICK COMPANY, of Quincy, Ill., has been incorporated with a capital stock of $30,000 to manufacture magneto coils and deal in all kinds of electrical apparatus. The incorporators are Judge C. E. Epler, August R. Dick and Henry F. Dayton.

THE ELECTRIC STEEL & METALS CO., LTD., has been incorporated to carry on business as railway, civil, mining and electrical engineer and dealer in electrical supplies, with headquarters at Welland, Ont.

THE INDUSTRIAL DEVELOPMENT CORPORATION, of Portland, Maine, has been organized with a capital stock of $500,000 for the purpose of carrying on electrical and industrial enterprises of all kinds. John H. Pierce is president and Robert M. Pennell, treasurer, both of Portland, Maine.

THE ISRAEL & PINE MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Charles L. Apfel, Abraham Kamen and Lucien Ebert, of 165 East 128th Street, New York, N. Y.

THE MODERN EQUIPMENT COMPANY, of Ashtabula, Ohio, has been incorporated by Clinton C. Faust, J. L. Smith, David Loeb, George Walker and W. F. Rowdon. The company is capitalized at $10,000 and proposes to manufacture and deal in power plants, home laundries and home equipment.

THE NATIONAL STAMPING & ELECTRIC WORKS, of Chicago, Ill., have increased their capital stock from $50,000 to $75,000.

THE OCTO ENGINEERING ASSOCIATION, INC., of Rochester, N. Y., has been incorporated with a capital stock of $10,000 to carry on an electrical and mechanical engineering business. The incorporators are: Joseph M. Stabel, John J. Eyre and Louis A. Kaplan, of 13 Fien Street, Rochester, N. Y.

THE O'SHEA-WRIGHT ELECTRIC CORPORATION, of Elmira, N. Y., has been incorporated by David S. O'Shea, Charles O. Wright and Frank W. Wright, 409 Jefferson Street, Elmira. The company is capitalized at $5,000 and proposes to do a general electrical business.

THE PHONE CALL RECORDER COMPANY, of Wilmington, Del., has been incorporated by R. Boyle Cooling, Clarence J. Jacobs and Henry W. Davis, all of Wilmington, Del. The company is capitalized at $250,000 and proposes to manufacture and deal in electrical utensils of all kinds.

HARRY A. PORTER, INC., has been granted articles of incorporation for the purpose of buying, manufacturing and selling electrical appliances. Capitalization, $2,500. Incorporators: H. A. Porter, Roland L. Porter and J. L. Porter.

THE RADIO ENGINEERING COMPANY OF AMERICA, of New York, N. Y., has been chartered with a capital stock of $100,000 to manufacture and deal in electrical, magnetic and mechanical devices. The incorporators are: T. Nieman Lally, B. S. Rockwell and Thomas T. Trapnell, all of 71 Broadway.

THE SANTA CLARA CONSTRUCTION COMPANY has filed articles of incorporation under the laws of the State of Maine with a capital stock of $500,000 for the purpose of constructing and dealing in electric railroad and electric plants. E. M. Leavitt, of Winthrop, Maine, is president.

THE SCHAEFER-FRENZEL COMPANY, of Detroit, Mich., has been organized with a capital stock of $50,000 to manufacture and deal in air compressors, machinery and electrical appliances.

THE TILSONBURG ELECTRIC CAR COMPANY, of Tilsonburg, Ont., Can., has been incorporated with a capital stock of $40,000 by T. J. Bailie, A. E. Medhurst and J. Chandler Prescott.

THE UNIVERSAL EQUIPMENT COMPANY, INC., of New York, N. Y., has been incorporated with a capital stock of $50,000 by George Gray, Theodore W. Hatfield and Isaac B. Ownes, 617 West 143d Street, New York. The company proposes to manufacture and deal in internal combustion engines and motors.

THE VOLT ELECTRIC COMPANY, LTD., of Toronto, Ont., has been incorporated with a capital stock of $40,000 to manufacture and deal in electrical appliances, etc. The head office of the company will be in Toronto.

THE VOLTA MACHINE MANUFACTURING COMPANY, INC., of New York, N. Y., has been incorporated with a capital stock of $20,000 to manufacture machinery used in generating electricity. The incorporators are: Thomas D. Finizio, Frank V. Giliberti and Antonio Petraglia, 2258 First Avenue, New York, N. Y.

THE WABASH ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to do an electrical contracting and construction business. The incorporators are: Fred Frost, Joseph L. Toohey and John P. O'Shaughnessy.

New Incorporations

ASHTON, IDA.—The Ashton & St. Anthony Pwr. Co., Ltd., has been incorporated with a capital stock of $250,000 by A. Whitten, L. M. Capps, N. N. Holm and E. M. Harris. The company will erect a power plant three miles from Ashton.

SPRING VALLEY, ILL.—The Spring Valley Utilities Co. has been incorporated with capital stock of $1,000,000 to manufacture electrical energy for all purposes. The incorporators are Charles H. Brown, Roy W. Brown, Constant Brown and Harry E. Brown.

BURT, IA.—The Burt Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by L. M. Owens, president; M. J. Mann, vice-president; C. B. Chipman, secretary; H. O. Beull, treasurer.

MINNEAPOLIS, MINN.—The Pioneer Pwr. Co. has been incorporated with a capital stock of $50,000, for the purpose of developing water-power and operating electric light and power plants. The incorporators are B. N. Johnson and O. A. Johnson, of Fergus Falls, Minn., and R. A. Lundquist, of Minneapolis, Minn.

LIBERAL, MO.—The Liberal Lt. Co. has been incorporated with a capital stock of $7,200 by C. Lipscomb, M. M. Jones and C. H. Dixon.

OMAHA, NEB.—The Republican River Pwr. Co. has been incorporated with a capital stock of $100,000 by F. B. McDonald, M. L. Gardner, A. E. Hansen, L. R. Yost and C. G. Eckman. The company proposes to do a general water-power business and to generate and distribute electricity for lamps and motors.

MORRISTOWN, N. Y.—The Gregory El. Co. has been incorporated by Arthur W. Gregory, Edna M. Gregory and A. Sophia Gregory, all of Morristown. The company is capitalized at $4,000.

NEW YORK, N. Y.—The Eastern Tennessee Transportation & Development Co. has been incorporated with a capital stock of $10,000 by George H. Burt, John Foster Dulles and John K. Byard, 155 East Seventieth Street, New York, N. Y. The company proposes to generate electricity, manufacture ice, salts and chemical products.

THELMA, N. C.—The Roanoke River Development Co. has been incorporated by W. C. Whiner, Fritz Sitterding and others of Richmond, Va. The company will take over the Roanoke Navigation & Wtr. Pwr. Co., which was organized to construct a hydroelectric power plant on the Roanoke River.

SPRINGFIELD, OHIO.—The Gray Electric Co. has been incorporated with a capital stock of $10,000. The incorporators are M. H. Gray, A. E. Spining, H. M. Snyder, George P. Arnold and O. G. McCain.

WEST LAFAYETTE, OHIO.—The West Lafayette Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by C. H. Howell, K. K. Garret, E. A. Crawford, W. A. Himebaugh and F. E. Pomerene. The company proposes to install an electric-light system in West Lafayette. Electricity to operate the system will be secured from the Coshocton plant.

OKLAHOMA CITY, OKLA.—The Pub. Ser. Corpn. of Oklahoma has been incorporated with a capital stock of $3,000,000 to operate gas and electrical plants, street and interurban railways and ice plants. The principal place of business will be located in Oklahoma City, with branch offices in Tulsa, Guthrie, Vinita, Atoka, Lehigh, Coalgate, Chickasha and Lawton, and a business office in Chicago, Ill. The incorporators are: H. I. McCracken, C. Sullivan, A. E. Johnson, E. J. Cligett and John Rapp.

TULSA, OKLA.—The Ox-Bow Bend Pwr. Co. has been chartered with a capital stock of $100,000 for the purpose of building a hydroelectric power plant on the Arkansas River, about 60 miles from Tulsa. The incorporators are: C. P. Chenault, L. D. Lewis, Floyd E. Lewis, J. O. Campbell and L. W. Mason.

EASTON, PA.—The Dolaburne Pwr. Co. has been incorporated with a

capital stock of $5,000 by F. V. Shannon, 450 West One Forty-ninth Street, New York, N. Y.

HARRISBURG, PA.—The Wayne County Ry. Co., Honesdale, was recently incorporated with a capital of $100,000. M. B. Allen, Honesdale, chief incorporator.

PHILADELPHIA, PA.—The Northampton El. Co. has been granted a charter with a capital stock of $5,000. J. S. Murtaugh, of West Chester, is among the incorporators.

PHILADELPHIA, PA.—The Hulmeville Lt. Co. has been granted a charter with a capital stock of $5,000. Walter T. Bilyeau, 6352 Sherman Street, Germantown, is one of the incorporators.

HOT SPRINGS, S. D.—The Cheyenne River Pwr. & Irrigation Co. has been incorporated by George A. Turner, John W. Parks and Henry Marty. The company is capitalized at $50,000 to develop electrical power on the Cheyenne River in the Black Hills section.

HUDSON, S. D.—The Hudson El. Lt. & Pwr. Co. has been incorporated with a capital stock of $10,000 by J. B. Bradley, C. F. Johnson, T. N. Torkelson, P. F. Way and others, all of Hudson.

MEMPHIS, TENN.—The Blue Ridge Pwr. Co. has been incorporated with a capital stock of $25,000 by James G. Johnson, W. M. Cox, C. E. Gore and E. N. Rogers.

HAMILTON, TEX.—The Hamilton Mill & Pwr. Co. has been incorporated with a capital stock of $30,000. The incorporators are: H. M. Weiser, C. E. Horton and W. B. Claunch.

LADONIA, TEX.—J. A. Bishop & Co. have been incorporated with a capital stock of $15,000 for the purpose of generating and transmitting power and manufacturing ice, etc. The incorporators are: J. A. Bishop, Grover Bishop and W. W. Bomar.

SALT LAKE CITY, UTAH.—The Swan Creek El. Co. has been incorporated with a capital stock of $20,000. The incorporators are B. E. Slusser, Ola Transtrum, E. M. Pugmire, Chester Transtrum and Ezra J. Howell.

VANCOUVER, WASH.—The Washington Farm Land Co., through James P. Stapleton, has been incorporated with a capital stock of $1,000,000.

CHARLESTON, W. VA.—The Miners' Lt. & Pwr. Co. has been chartered with a capital stock of $250,000 to generate electricity for lamps, heaters and motors and to own and operate coal mines, etc. The incorporators are: J. H. Gaines, A. B. Koontz, G. G. Todd, F. R. Hurlburt and R. Kemp Morton, all of Charleston.

Trade Publications

GUY CLAMPS.—A booklet with the imprint of W. N. Matthews & Brother, St. Louis, Mo., refers to their "Baby" boltless guy clamps. Emphasis is laid on the strength of this new "baby" clamp. A trial proposition is made.

POLES AND BRACKETS.—The Elmer P. Morris Iron Works, Inc., 90 West Street, New York, have issued Catalog No. 25, Section No. 3, which contains illustrations, brief descriptions and dimensional data of plain and ornamental arc and incandescent lamp poles, brackets, pins and fittings.

TELEPHONES.—Bulletin No. 5 issued by Murray E. Main, Delaware, Ohio, describes and illustrates the Main telephone. Its several new features are set forth, among which are the accessibility of the induction coil and condenser without the aid of any tool, a switch hook easily accessible and ample room for inspection.

AUTOMOBILE TELEPHONE.—The Pape Signal Phone Company, New York, has issued an illustrated oblong folder of eight pages which refers to its passenger-driven, instant-signaling, loud-speaking limousine "phone," called the autophone. This device is used for transmitting the orders of the passenger of a car to the chauffeur, the tone being magnified.

PAPER-MILL ENGINES.—The American Engine Company, Bound Brook, N. J., has issued a sixteen-page pamphlet which describes and illustrates the new American-Ball four-cylinder paper-mill engine. These engines have a wide speed range. Drawings are shown of the two-cylinder angle-type variable-speed engine and also of the two-cylinder horizontal variable-speed paper-mill engine.

AIR WASHERS.—In its Bulletin No. 51 the Spray Engineering Company, 201 Devonshire Street, Boston, gives information with respect to its system of washing and cooling air in large buildings. This system is said to be adapted also for putting the needed moisture in the air in the dry atmosphere of buildings in winter. The method of operation is explained in the text and by diagrams.

CONSULTING ENGINEERS' BOOKLET.—In a twenty-four-page booklet being sent out by the H. A. Strauss Company, Stock Exchange Building, Chicago, are set forth the facilities of this company for undertaking consulting, designing, supervising and general contracting work. Miniature illustrations accompanied by brief reference to a number of successful installations planned by this company are shown.

ARC LAMPS.—Bulletin No. A-4035, issued by the General Electric Company, describes series luminous-arc lamps for operation on series direct-current circuits of either 4 amp or 6.6 amp. The bulletin contains a number of reproductions of photographs made by the light from these arc lamps, which show the illumination secured. It also contains a list of some of the cities and towns in which the lamps are installed.

BRONZE—The American Brass Company, through its Ansonia (Conn.) brass and copper branch, has issued a thirty-six-page pamphlet referring to Tobin bronze, a metal for use for all purposes where a bronze resistant to corrosion of high tensile strength and elastic limit is required. Following a brief talk on this substance are given the results of some recent tests on Tobin bronze rods and plates and a number of testimonial letters from satisfied users.

ENGINEERING SERVICE.—In a folder bearing the title "The Question of 'Tied-Up' Capital" the Providence Engineering Works, Providence, R. I., offer their "specialized engineering service" to manufacturers with a view to making for them special parts in cases where the installation of special machinery for certain parts by manufacturers themselves might represent "tied-up capital." A corps of experienced engineers is placed at the disposal of the manufacturers for the study of their individual problems.

STEAM PUMPS.—A catalog has been published by the Blake & Knowles Steam Pump Works, 115 Broadway, New York, which gives within its eighty-four pages comprehensive illustrated information regarding many types of pumps made by this company, including ammonia, artesian, deep-well and sinking pumps, automatic feed pumps and receivers, boiler feed and pressure pumps, condenser and vacuum pumps, direct-acting air compressors and blowers, electric service, filter, hydraulic, light-pressure service and other pumps.

COOLING TOWERS.—Natural-draft towers of the Wheeler-Balcke design are described in Bulletin 109 of the Wheeler Condenser & Engineering Company, Carteret, N. J. These towers are of wood with an improved water-distributing system and compact cooling stacks which cool the water on the "drop and film" principle. In the bulletin are discussed the theory of cooling and the necessity of scientific design of condensers and cooling towers. The bulletin is illustrated with photographs of many interesting types of natural-draft towers.

HOUSE-LIGHTING PLANTS.—The Edison Storage Battery Company, Orange, N. J., has recently published an attractive booklet descriptive of the Edison battery for house-lighting plants. It contains a number of illustrations showing the arrangement of lamps and household appliances in a country home. Specifications are given for lighting plants with equipments from six 15-watt tungsten lamps running for seven hours per day up to plants which will supply energy for 155 20-watt tungsten filament lamps running about eight hours a day.

RAILROAD WORK.—Under the title "Work Done," Railroad Shop Edition No. 5, Westinghouse, Church, Kerr & Company have published a forty-eight-page pamphlet, the purpose of which, as stated in the preface, is to describe briefly certain shop design, construction and equipment work done by various steam-railroad clients through the agency of this company. The descriptions are interesting and will suggest to the readers the possibility of utilizing similar methods in their organizations. The work is effectively illustrated with fac-simile blueprints and half-tones.

CONDENSERS.—Bulletin No. 15 of the Alberger Pump & Condenser Company, New York, deals with Spiroflo centrifugal condensers. This apparatus consists of a centrifugal removal pump, the suction pipe of which is connected to a hot-well, above which is mounted a condensing chamber. The hot-well carries a balanced float for controlling the speed of the removal pump, and the condensing chamber an improved automatic high-water level vacuum breaker. A separate dry-air pump of either the crank-and-flywheel engine-driven or the centrifugal-turbine-driven type is provided for removing the air and non-condensable vapors.

CORROSION.—The American Sheet & Tin Plate Company, Frick Building, Pittsburgh, Pa., has published a reprint of Mr. D. M. Buck's paper on "Copper in Steel—the Influence on Corrosion," which was read at the recent meeting of the American Chemical Society. Mr. Buck gives full details of some instructive experiments made on roofing sheets of ordinary steel with the object of establishing the relative value of small amounts of copper in metal roofing when exposed to natural corrosion under varied atmospheric conditions. The paper is well presented and generously illustrated and contains valuable tables.

WIRE WHEELS.—Walter E. Eichhoff, South Pasadena, Cal., in a four-page folder, describes and effectively illustrates the method of operation of the Eichhoff No. 102 combined take-up and pay-out reel. By the use of this device one man can coil up wire without assistance, thus effecting economy in labor. The reel is well adapted for use by electric-light, telephone and telegraph companies. The No. 104 reel, to which a page is devoted in this bulletin, is suited for railway signaling, telegraph and telephone departments, especially for emergency work, as it takes up little space. Mathias Klein & Sons, Chicago, also manufacture these reels.

CENTRIFUGAL PUMPS.—"Wheeler Condenser Pumps" is the title of Bulletin No. 108 of the Wheeler Condenser & Engineering Company. This bulletin considers the general construction of centrifugal pumps, illustrating a cross-section of a typical pump and also showing by photographs the general design of pump casing and impeller. It also considers the subject of centrifugal pumps for condenser work, taking up under this heading centrifugal circulating pumps for surface condensers, centrifugal hot-well pumps and tail pumps, outlining the requirements and illustrating by charts the type of pump characteristics required to meet the service.

Business Notes

STEEL CITY ELECTRIC COMPANY.—Mr. Dale B. Scarborough has been appointed sales representative for the Steel City Electric Company in eastern Pennsylvania, New Jersey (except Newark and north thereof), Delaware, Maryland, Virginia and the District of Columbia, with offices at 5522 North Third Street, Philadelphia. Mr. R. W. Young will represent the company in the New England States, the metropolitan district of Greater New York, the city of Newark and the territory north thereof, with offices at 27 Thames Street, New York. The Steel City Electric Company, the main offices of which are in Pittsburgh, manufactures outlet boxes, bushings, lock nuts, fixture stems, conduit benders, etc.

MANUFACTURERS' SALES SERVICE.—An enterprise that promises to be of benefit to manufacturers located at a distance from New York City and not represented there by a branch office or resident salesman has just been announced. The Manufacturers' Sales Service, as the name indicates, will render an introductory and selling service to manufacturers similar to that of a branch office. The service is offered only to manufacturers in the building trades lines whose products are of interest to architects, owners, engineers, builders and sub-contractors on buildings. The office will be in the new Architects' Building, 101 Park Avenue, New York City. Mr. William R. Pertak is the manager of the Manufacturers' Sales Service, which will aim to keep a limited number of subscribers in different non-competitive lines in touch with New York City building operations and prospects.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 17, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York]

1,064,719. TELEPHONE TRUNKING SYSTEM; E. D. Fales, La Grange, Ill. App. filed July 6, 1908. Two-way trunk in a two-wire automatic telephone-exchange system.

1,064,722. RHEOSTAT; W. G. Gillig, Chicago, Ill. App. filed Feb. 1, 1913. A movable-pressure member forces successive portions of a flexible contact member into contact with successive convolutions of the resistance wire.

1,064,724. CASING; M. Guett, Hartford, Conn. App. filed Sept. 15, 1911. Multiple lock for lamp-socket shells.

1,064,739. ELECTRICALLY HEATED SOLDERING IRON; M. H. Johnson, Utica, N. Y. App. filed Dec. 18, 1909. Heating coil is hermetically sealed in heater case having autogenous joints.

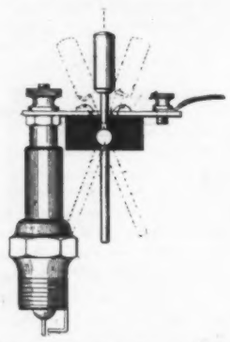
1,064,749. ELECTRIC-CURRENT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Dec. 12, 1904. Current is automatically maintained within such limits as are required for the desired operation of the device. (Sixty-four claims.)

1,064,805. SYSTEM OF TELEGRAPHY; G. Wood, Kansas City, Mo. App. filed April 29, 1909. Receiving instrument prints the messages in page form.

1,064,809. MOTOR CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed July 26, 1909. Circuits of both the motor armature and shunt-field winding are controlled from a distant point.

1,064,819. TELEGRAPH KEY; H. C. Dauphinais, Fargo, N. D. App. filed Nov. 27, 1912. Flat, obliquely extending finger piece secured to the knob of the key lever.

1,064,831. PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Operating lever pivoted outside of shell and connected by insulating link to the switch mechanism.



No. 1,065,327—Spark-plug Connector and Switch.

1,064,832. PULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed Oct. 3, 1911. Reversible operating lever pivoted within the shell and extending out through an opening in the shell.

1,064,833. SEPARABLE ATTACHMENT PLUG; H. Hubbell, Bridgeport, Conn. App. filed Jan. 2, 1912. Engaging contact blades carried by cap and base.

1,064,834. FULL SOCKET; H. Hubbell, Bridgeport, Conn. App. filed May 6, 1912. Operating bar made in two insulated separably connected parts.

1,064,846. ACCESSORY FOR THE IGNITION SYSTEMS OF INTERNAL-COMBUSTION ENGINES; M. H. Merrill, Boston, Mass. App. filed May 10, 1911. Cutout switch attached to spark plug.

1,064,893. INSULATING COMPOUND AND PROCESS OF MAKING THE SAME; G. F. Dreher, Schenectady, N. Y. App. filed Dec. 29, 1908. For commutator segments, etc.; powdered refractory earth, asbestos and silicate of soda compressed and fired under pressure at high temperature.

1,064,899. TRAIN ANNUNCIATOR; L. W. Givan, Spring Lick, Ky. App. filed May 13, 1911. To enable the dispatcher to ascertain at any time if a train has passed a station since the last time he called.

1,064,920. CONNECTOR FOR ELECTRIC WIRES; D. R. Lovejoy, Freneau, N. J. App. filed Sept. 27, 1912. For making connection between circuit wires and fixture wires of a chandelier, etc.; shell with concentric grooves and clamping screws with concentric grooves on its end.

1,064,927. INDICATOR OPERATING MECHANISM; E. J. Pace, Los Angeles, Cal. App. filed May 29, 1912. For operating indicators, signals, etc., on moving trains.

,064,955. CONNECTING DEVICE; E. G. K. Anderson, Chicago, Ill. App. filed July 29, 1910. Lamp socket with bayonet joint with a base.

1,064,957. ELECTRICAL CONNECTING APPARATUS; G. A. Betulander, Södertörns Villastad, Sweden. App. filed Jan. 4, 1912. Selector of automatic telephone exchange.

1,064,981. SYSTEM AND METHOD OF PRODUCING BY MEANS OF COMBUSTION ENGINES ELECTRIC CURRENT; W. A. T. Müller, Berlin-Steglitz, Germany. App. filed March 29, 1909. Independent generator sets driven by independent gas engines are all controlled by one man by starting one unit and exciting the other generator units as motors.

1,064,983. ELECTRIC-BATH CABINET; T. E. Murray and G. K. Jessup, New York, N. Y. App. filed Dec. 30, 1912. Hollow wall sections flexibly connected and lamps seated in recesses in said sections.

1,064,985. ELECTRIC CUT-OUT; T. A. Murray, Jr., New York, N. Y. App. filed Feb. 4, 1913. Fuse carriers mounted detachably on a pivoted support so that they may be moved into and out of co-operation with the contacts.

1,064,991. ELECTRODE HOLDER; H. J. Potts, Kansas City, Mo. App. filed June 20, 1912. A flat-sided adjusting screw for manually advancing the electrode through the holder jaws; for headlamps, etc.

1,964,992. METALLURGY OF ZINC; A. L. Queneau, Philadelphia, Pa. App. filed April 7, 1909. Furnace lining with solid peripheral conductors separated by breaks which are bridged by molten resisting material.

1,064,997. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed Jan. 20, 1910. Selective system in which the various devices at the substations are operated by current supplied at the central station.

1,065,009. CONTROLLER; P. S. Turner, Chorlton-cum-Hardy, England. App. filed Jan. 15, 1913. Shunt circuit around motor armature is made and broken and amount of resistance therein is varied independently of the amount of resistance in series with the motor.

1,065,015. RESISTANCE; W. R. Youmans, Columbus, Ohio. App. filed Oct. 21, 1909. Continuous flexible resistance element held under tension in an extensible frame.

1,065,037. HEATING UNIT; B. Falkenburg, Ontario, Cal. App. filed May 27, 1912. For percolators, etc.; semi-cylindrical heat-conducting members with an interposed sheet of insulation around which a wire is wound.

1,065,068. PROTECTOR FOR TELEGRAPH AND TELEPHONE CROSS-ARMS AND PINS; H. G. Newell, Le Raysville, Pa. App. filed Oct. 7, 1912. Annular washer with knife-edge flanges which bite into the wood, the washer serving to cover the joint between the cross-arm and the pin seated in the arm.

1,065,090. APPARATUS FOR UNIFORMLY COATING STRIPS OF METAL, WIRE AND THE LIKE UNDER CONTINUOUS ACTION; F. Werth, Milan, Italy. App. filed Sept. 4, 1912. Metal to be coated is moved between channeled anodes.

1,065,114. ELECTRIC RAILWAY SIGNALING SYSTEM; F. P. Cremona, Baltimore, Md. App. filed April 11, 1910. Contact rails on track and brush on train.

1,065,131. SEALING TOOL. La V. V. Hull and H. B. Moorehead, McComb, Ohio. App. filed March 8, 1913. Stick of sealing material is guided in end of tool; switch is located within handle of tool.

1,065,141. PROJECTOR CARBON; J. F. Kerlin, Lakewood, Ohio. App. filed Jan. 8, 1912. Lengthwise furrow in carbon causes the arc to remain stationary; furrow is rounded at the bottom to prevent the carbon cracking when baked.

1,065,144. METHOD OF AND MEANS FOR HEATING GASES TO HIGH TEMPERATURES; C. F. R. Von Koch, Stockholm, Sweden. App. filed June 10, 1911. Preheats gas and incloses it in envelope of comparatively cool gas and advances the preheated gas with its inclosing envelope past a further source of heat.

1,065,148. ELECTRIC COOKER; C. C. Lillibridge, Hutchinson, Kan. App. filed Aug. 12, 1912. Electric heat radiator removably engaged within the cooker so as to heat the cooker simultaneously with the heating of the radiator.

1,065,151. ELECTRIC SIGNALING SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Dec. 27, 1909. For apprising driver of the vehicle that the regular signal has failed.

1,065,190. STRAIN RELIEF; T. J. Tobin, Albany, N. Y. App. filed Nov. 16, 1912. Flat plate of flexible insulating fiber with independent wire passages.

1,065,195. SOLDERING IRON; J. White, Philadelphia, Pa. App. filed Oct. 17, 1912. Compressed air used to force out the molten solder.

1,065,302. MEANS FOR TRANSFERRING LOAD FROM ONE GENERATOR STATION TO ANOTHER; E. F. Dutton, Schenectady, N. Y. App. filed Nov. 2, 1911. Automatic circuit-breakers and connections by which load may be transferred in whole or in part to either generator station without interrupting supply of current to the load and without throwing stations into multiple more than momentarily.

1,065,327. SPARK-PLUG CONNECTOR AND SWITCH; C. E. Semple, Jr., Youngstown, Ohio. App. filed April 27, 1911. For attachment to spark plugs to provide a connection to the plug or to short-circuit current to the base of the plug.

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NEW YORK, JUNE 21, 1913

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Alphabetical Index and Classified Directory, Pages 103, 104, 105, 106

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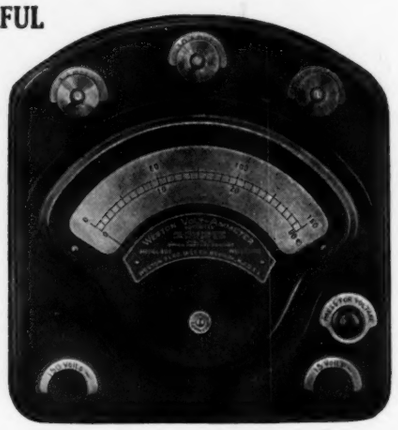

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JAMES H. McGRAW, *President*

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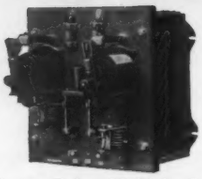

Series Relay Multiple Solenoid Type Automatic Motor Controller. Bulletin 6159.

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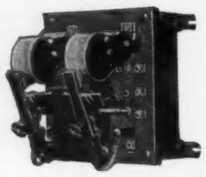

A. C. Self-starter for single-phase and squirrel cage polyphase motors. Bulletin 9600.

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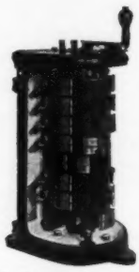

A. C. Starter Drum Type. Cover Removed. Bulletin 9135.

Machine Tool Controller. Bulletin 5220.

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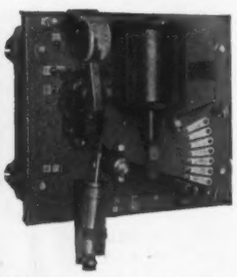
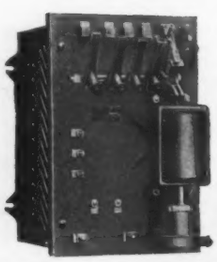
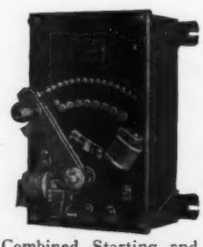
Series Relay Multiple Solenoid Type Controller with main line magnetic switch. Bulletin 6160.



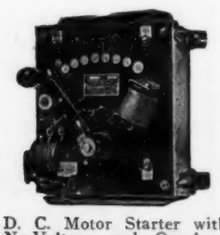
Self-starter with main line magnetic switch. Bulletin 6140.



Multiple Finger Automatic Starter. Bulletin 6105.



Combined Starting and Regulating Rheostat. **Bulletin 2240.**



D. C. Motor Starter with No-Voltage and Overload Release. Bulletin 2140.

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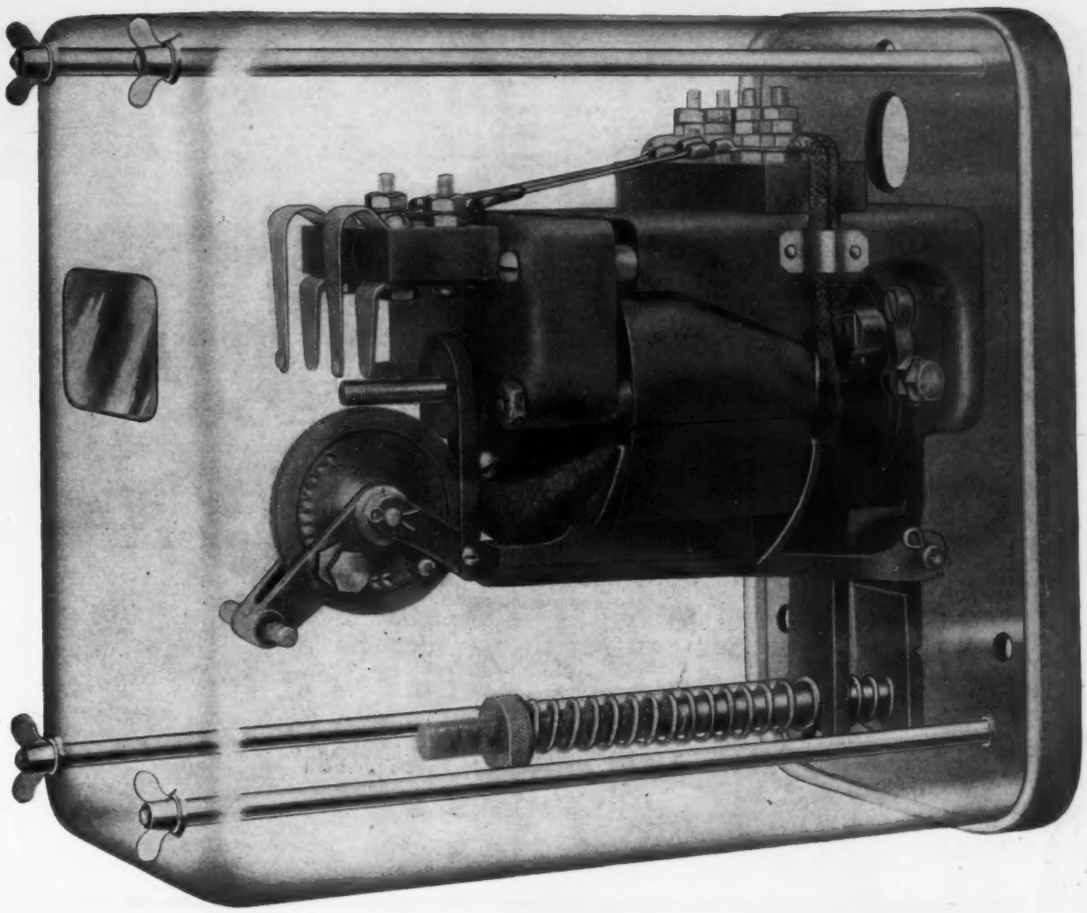

The Balance Wheel of a Watch

is the part that governs its accuracy—and what the balance wheel of a ship's chronometer is to the captain, your time limit relays are to you.

On them depend the continuity of your service and the financial success of your Company. The best is none too good. That is why you should use Condit Time Limit Relays. They will take care of overloads no matter how fast they come, will instantly reset when the current drops to normal, and cannot creep.

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CIRCUIT BREAKERS

A Word to Contractors

WHEN you meet specifications calling for I-T-E or equal, look out! The Engineer wants "I-T-E." He is the best judge of what is "equal." Sometimes actual comparison is made—the result is never in doubt. Even our competitors agree that the "I.-T.-E" has no equal.

THE CUTTER COMPANY
PHILADELPHIA

For Control of Pressure

in tanks, reservoirs, etc., by starting and stopping motor-driven apparatus, the

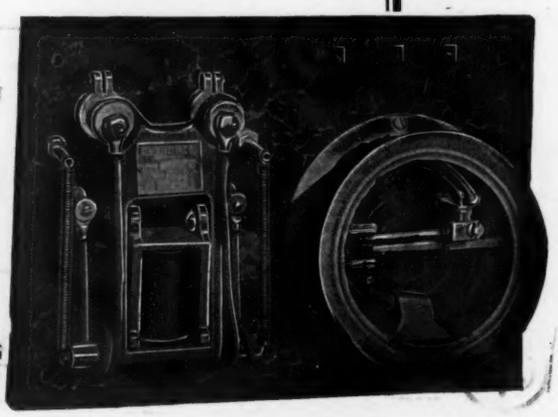
Sundh Gauge Type Regulator

will be found most satisfactory. The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

It can be set to operate on a pressure difference of about three to five per cent. A wider range may be obtained by screwing down the left-hand screw.

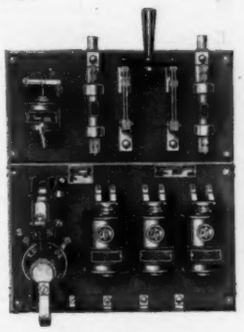
Full description is in the Sundh catalog. Write for a copy.



Sundh Electric Company
New York, U. S. A.

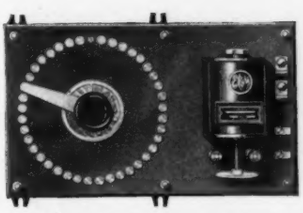
E. C. & M.
AUTOMATIC MACHINE TOOL CONTROLLERS

E. C. & M. Automatic Machine Tool Controllers provide the utmost convenience, speed, and accuracy in the control of the machine. In all their elements of operation they help to reduce that period of time when the machine is not operating productively. As has been said, "What is the use of cuts at high speed, ripping things to pieces, and then losing all we gain because we cannot cut the time between cuts. To cut your costs properly, you must cut the time between cuts."



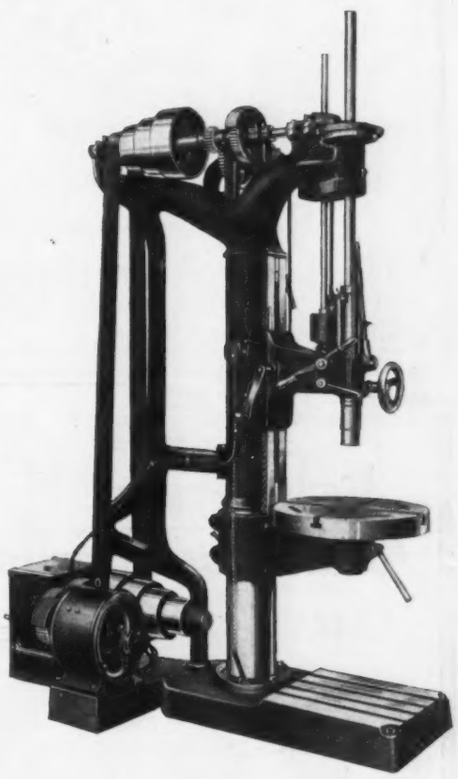
Type ASBK Automatic Motor Starter

Type S Push Button



Field Rheostat and Relay

An E. C. & M. Automatic Motor Starter, on a drill press, allows the workman to start and stop by merely pushing a button. No time is lost in shifting belts or carefully bringing a motor up to speed. The operator devotes all his time, energy and intelligence to drilling holes. As a result, he drills more holes per day, and is better pleased with his job because he is less fatigued at the end of the day.



If desired, an adjustable speed motor can be used, getting rid of cone pulleys.

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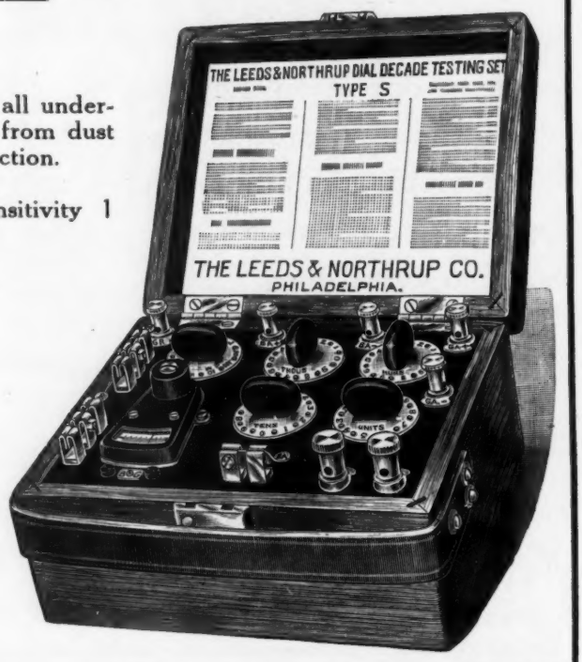
Directions—Complete directions for making resistance measurements and the loop tests for locating faults in lines and cables accompany each instrument.
Guarantee—Fully protects the purchaser against defects in material or workmanship.



Price, $60

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No Flexible Shaft

This combination Tachometer and cutmeter consists of a standard Tachometer with an attachment for obtaining surface speeds in feet per minute.
A rubber tired wheel of one foot in circumference can be attached to the shaft and the handle changed from the end to the side of the magneto, as shown above.

Since one R.P.M. equals one foot per minute, the scales read interchangeably.

Electric Tachometer Company
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Projector Lantern Work Involves High Temperatures

and for this service, or wherever a rugged, compact resistance is required,

Ward Leonard Enameled Resistances

always give excellent results. This enamel insulation is a guarantee against grounds and short circuits. They do not age in service.

Built in a wide variety of types and sizes suited to every requirement. The cut shows a projector unit without enclosing case.

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rather than
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Megger Testing Set of latest type.

The Megger-method is so entirely different from any other way of testing insulation or conductor resistance that we have asked a few Megger-users for "Hard facts" based on actual every-day experience. One of them says:

"We have one of your constant pressure meggers with a range of 5 to 1000 megohms. We have used this megger for testing cables, generators, motors, transformers and oil switches, and it has given very satisfactory results. Have on several occasions been able to locate faults in cables, which if not detected, might have caused serious breaks later on. We have in the past, before receiving the megger, been making periodic tests with either voltmeter or galvanometer methods, to keep posted as to the condition of the insulation of our equipment. Since receiving the megger, we have not used the voltmeter or galvanometer method, as the megger method is much quicker, better and more reliable."

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This Light-Load Adjustment Helps You Get What's Due You

It covers a wide range—cannot slip or change—no tools are needed. It is only one of the many good features which have led to the installation of

Columbia S. A. Watthour Meters

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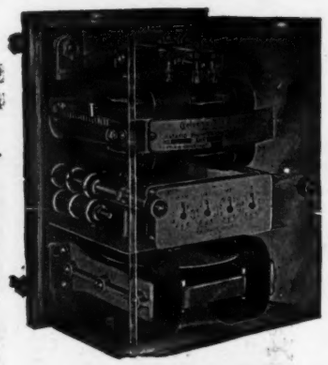
We have A. C. meters to match. For simplicity of construction, ease of adjustment, extreme accuracy and high torque, select Columbia Watthour meters.

Made in all types, styles and ranges. Ask for descriptive bulletin.



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Shunt and Series Types
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Large Size.

—and get the latest development in the switch-making art.

We have been perfecting these snap switches for a long time, and now offer you an article up to the Trumbull standard in every detail.

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will prevail in your meter department, as well as increased efficiency if you lighten the unnecessary burden your inspectors have been carrying and provide them with our

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Already adopted by hundreds of central stations.

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2

Type 35 Ammeter

More than 10,000 Type 35 HOYT METERS are in successful service in more than 6000 isolated plants in 19 different countries, and it is not yet six years old.

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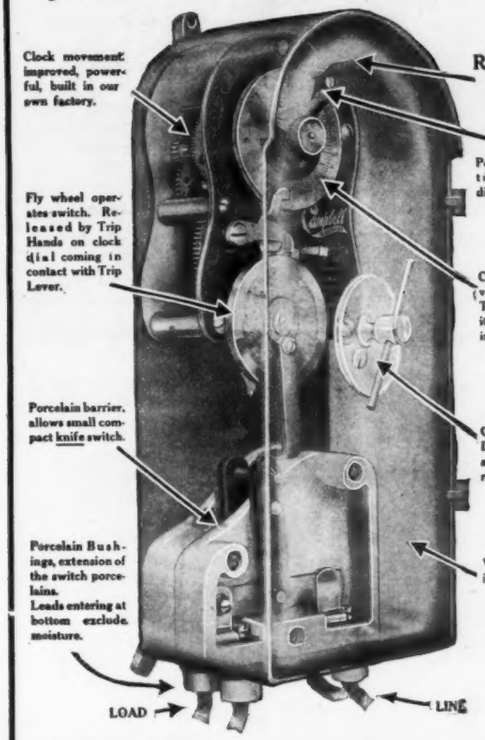
168 Hours Between Windings

A few turns of the key once a week is all the attention needed to secure perfect service with the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Pointer indicates time on clock dial.
Fly wheel operates switch. Released by Trip Hands on clock dial coming in contact with Trip Lever.
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Porcelain barrier, allows small compact knife switch.
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Porcelain Bushings, extension of the switch porcelains. Leads entering at bottom exclude moisture.
Weather proof iron box.
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It is unfailingly "on the job," turning the lights on or off at the exact predetermined time. We build five types to cover all requirements. For installations where it is convenient to wind and set the clock and switch each day, we offer

Type "A"—One-Day

—a low-priced, reliable time-switch. Can be installed wherever it is allowable to use an ordinary snap switch.

Clock removable from here to wind and set.
Supports allow space back of switch for wires.
Switch set by movement of lever to this position.
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Switch may be manually operated by this button independent of time switch mechanism.

Campbell Electric Co. Lynn, Mass.

Ask also for details on our comprehensive line of transformers for low-voltage Tungsten lighting.

Campbell Electric Company, Lynn, Mass.

Please send full particulars, bulletins and confidential prices on time switches to

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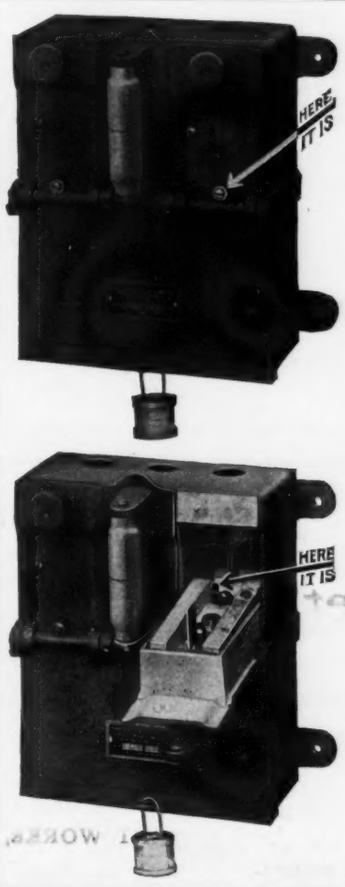

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IN PALMER SERVICE BOXES ARE SAFER THAN ENCLOSED FUSES

And Save 80% of your Fuse Expense

Let us tell you how.

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IS THE DUNCAN

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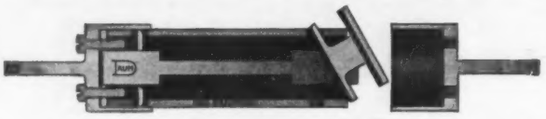
DAUM Refillable Cartridge Fuses

For Electric Light and Power Circuits



The Fuse to Choose

Why waste fuse money? Get a fuse that meets your specifications and still

Saves 95%

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The shell is good indefinitely. A few inches of standard fuse wire, a few minutes of a boy's time and a blown fuse is made good as new. There's your saving.

Free Sample

You can try out the Daum without expense. Say you want a sample. Say where you want to use it. You can have Daum fuses for light or power circuits in any size.

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Rotary Snap-Switch

on a

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These new Paiste Cut-Outs take the new type Single or Double Pole Switches of ALL manufacturers. They are Paiste, of course; just another of these specialties that makes us "the leading specialty manufacturers." Are you on our mailing list for booklets and catalogs?

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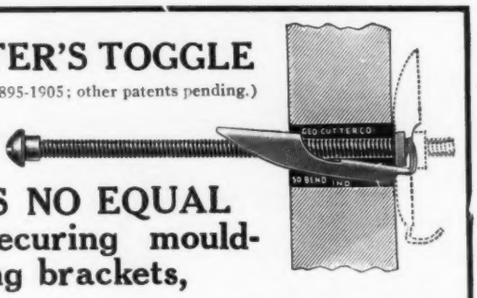
CUTTER'S TOGGLE

(Patented 1895-1905; other patents pending.)



HAS NO EQUAL for securing moulding brackets,

or any fixtures to walls and ceilings on which screws will not hold. It has no tiny rivet to limit its strength. Write for samples and price lists, stating fully your requirements.

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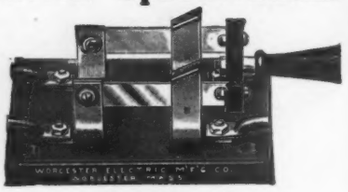

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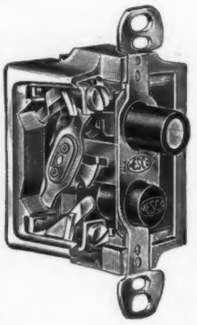

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Easy to wire.

Double Pole insures long life.

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—but trifles make perfection. And you'll find all the little perfection-making details you have a right to expect in a high-grade product, built right into

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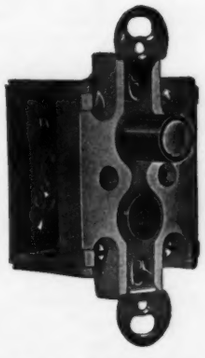

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For Electric Motor Drive
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How about carrying a stock of Hubbell Specialties and making it move with our help? Let's tell you the proposition.

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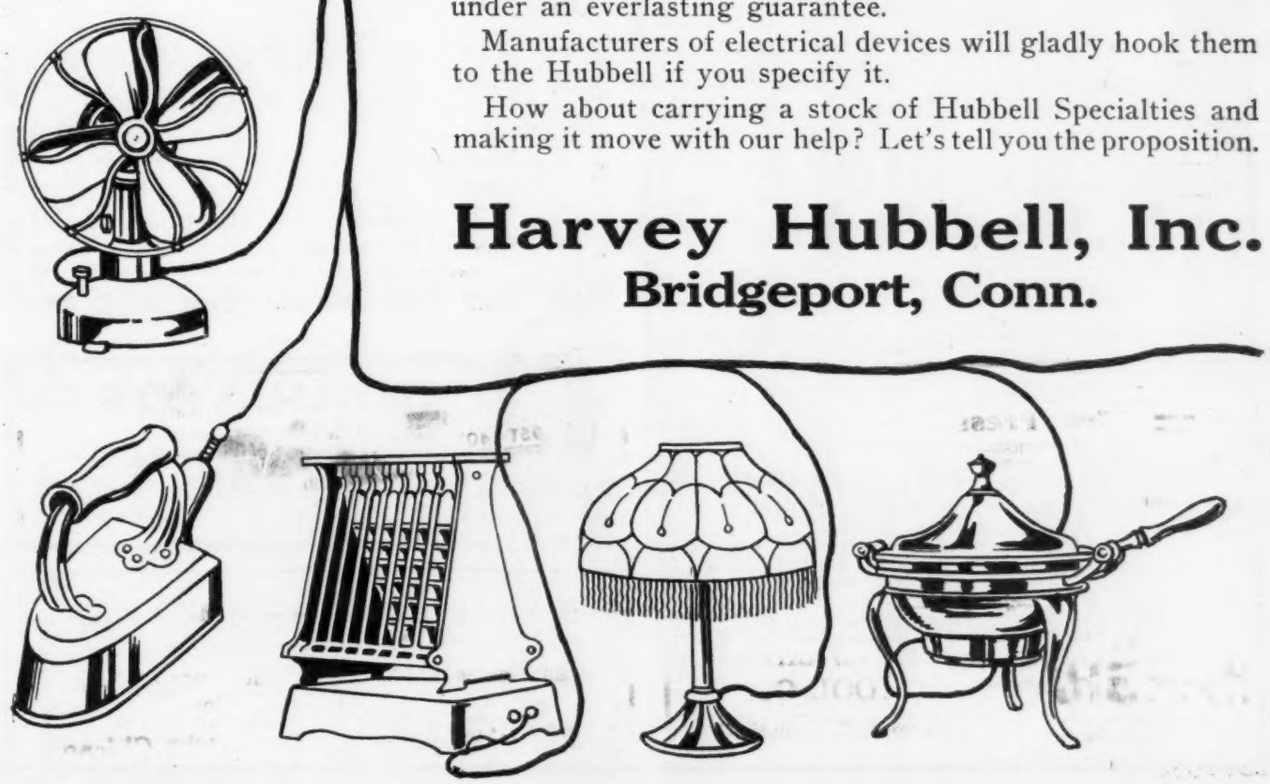

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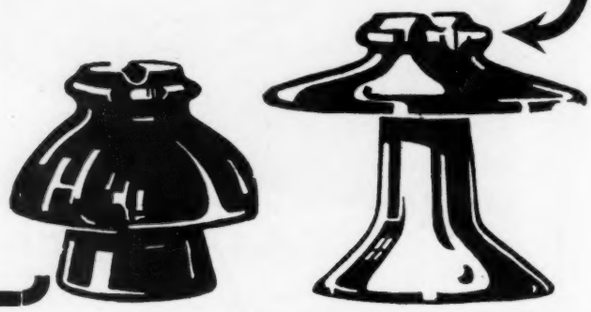
They are standard where UNINTERRUPTED SERVICE from electric power transmission, of all voltages and under every conceivable condition, is vital.



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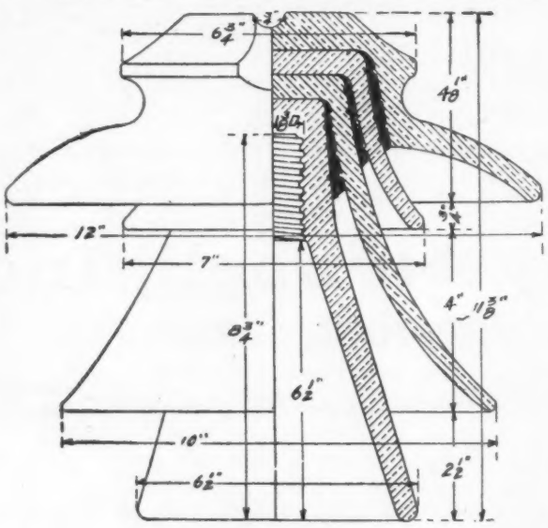

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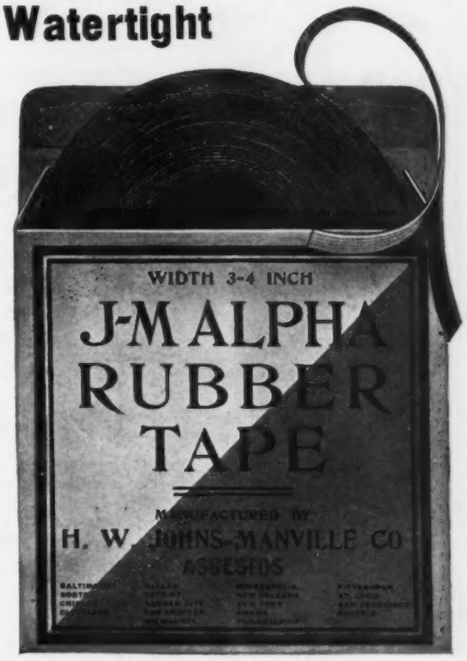

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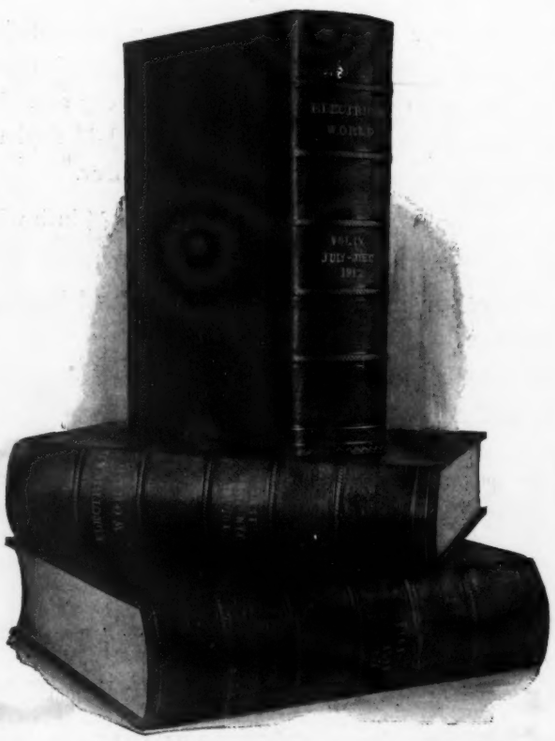

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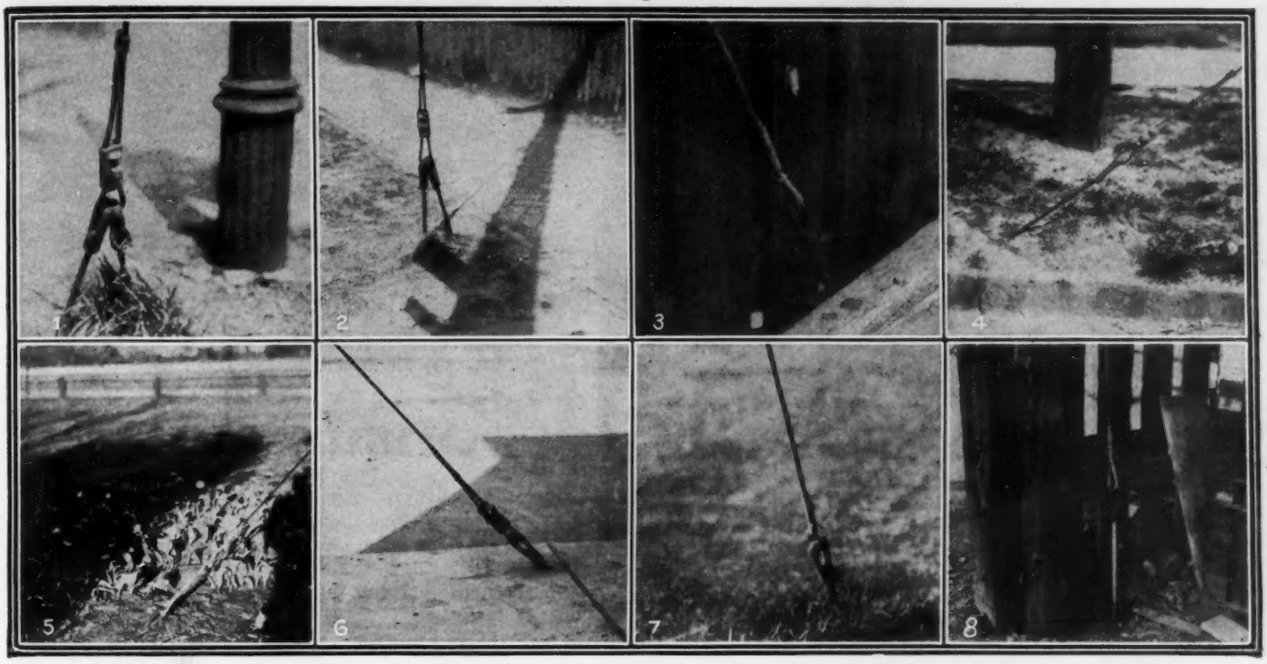

Views Showing Some of the 2500 Matthews Anchors Installed in Decatur, Illinois.

Difficult Problems in the Anchoring of Poles

Various problems arise in the anchoring of poles by reason of the frequent necessity of locating the poles in close proximity to lawns, gardens, fences, sidewalks, curbings, buildings, and in other surroundings where correct anchorage becomes at once a puzzle. The accompanying illustrations show a number of instances in which an anchoring difficulty was solved, the type used being the Matthews Guy Anchor.

In view No. 1 is shown the method of holding an extra strain at a point where it would have been exceedingly costly to have put down a dead man on account of the close proximity of a brick sidewalk and the gas lamp shade at the right of the picture. Two of the anchors were used to support this pole. The second view presents a condition similar to that in No. 1. Two anchors of 5-in. size were used and screwed down under the sidewalk as shown.

A close inspection of No. 3 shows a 6-in. Matthews' Guy Anchor screwed down in an 8-in. space between an inclined driveway. This is a situation where the digging of a hole would have been out of the question and the type of anchor used saved its cost in this installation over any anchorage which would have required digging. An anchor which was screwed down between a shade tree and the curbstone until it took a firm hold on the roots of the tree is shown in the fourth view, and is another example of a pole anchored securely in an extremely awkward place.

Many of the difficulties in pole anchorage are rather in the way of securing the consent of property owners than by reason of difficulties due to surrounding objects. A case of this kind might easily have arisen in connection with the installation shown in the fifth scene, where it was necessary to secure anchorage in a flower bed. Permission to dig a hole could not have been obtained, but the consent of the owner of the flower bed was readily secured for the type of anchor used. An instance in which a 6-in. Matthews' Guy Anchor saved a considerable amount of money is presented in No. 6. A section of the sidewalk about 8 ins. in diameter was chiseled out and the anchor inserted and screwed down to its full depth. A small amount of granitoid was used to finish the job, as shown. Another similar case is shown in Fig. 7, where permission was secured to put an anchor in a lawn and this was done without damage to the sod.

In the last view of the group is shown a guy carried over a fence into a lumber yard, where it is attached to a 6-in. Matthews' Guy Anchor that could not be installed to its full depth because of the surrounding obstructions. This anchor went through the winter just passed, in which there were three very heavy sleet loads on the pole. It is found that this anchor is holding and has not given a fraction of an inch. All these installations were made in Decatur, Illinois, where over 2,500 anchors of this type are in use by the Central Union Telephone Co., the Home Telephone Co., the Illinois Traction System and the electric light department of the city.

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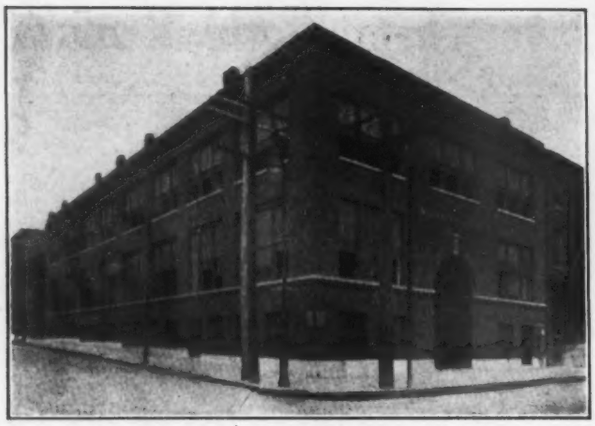
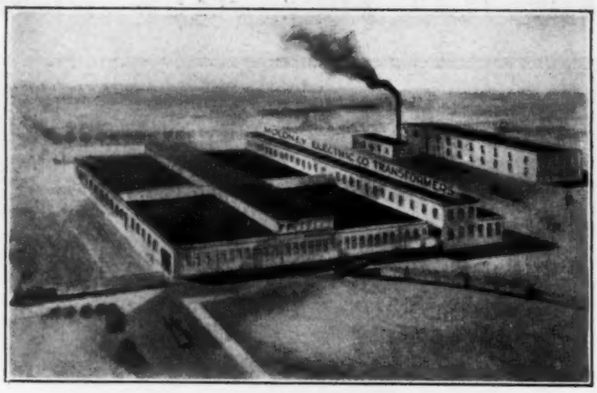


Moloney Electric Co. Factory, St. Louis.



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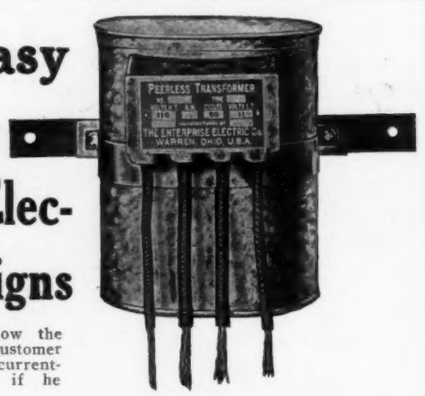

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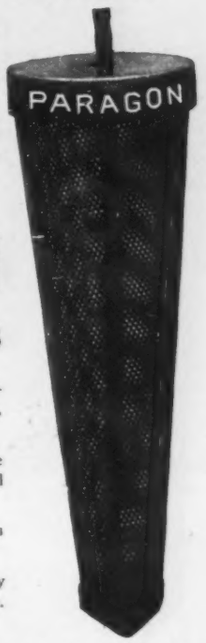

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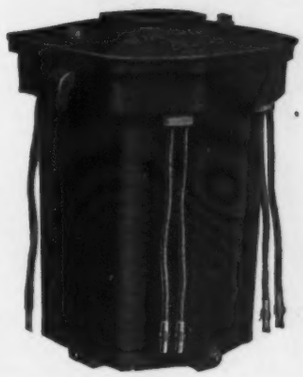

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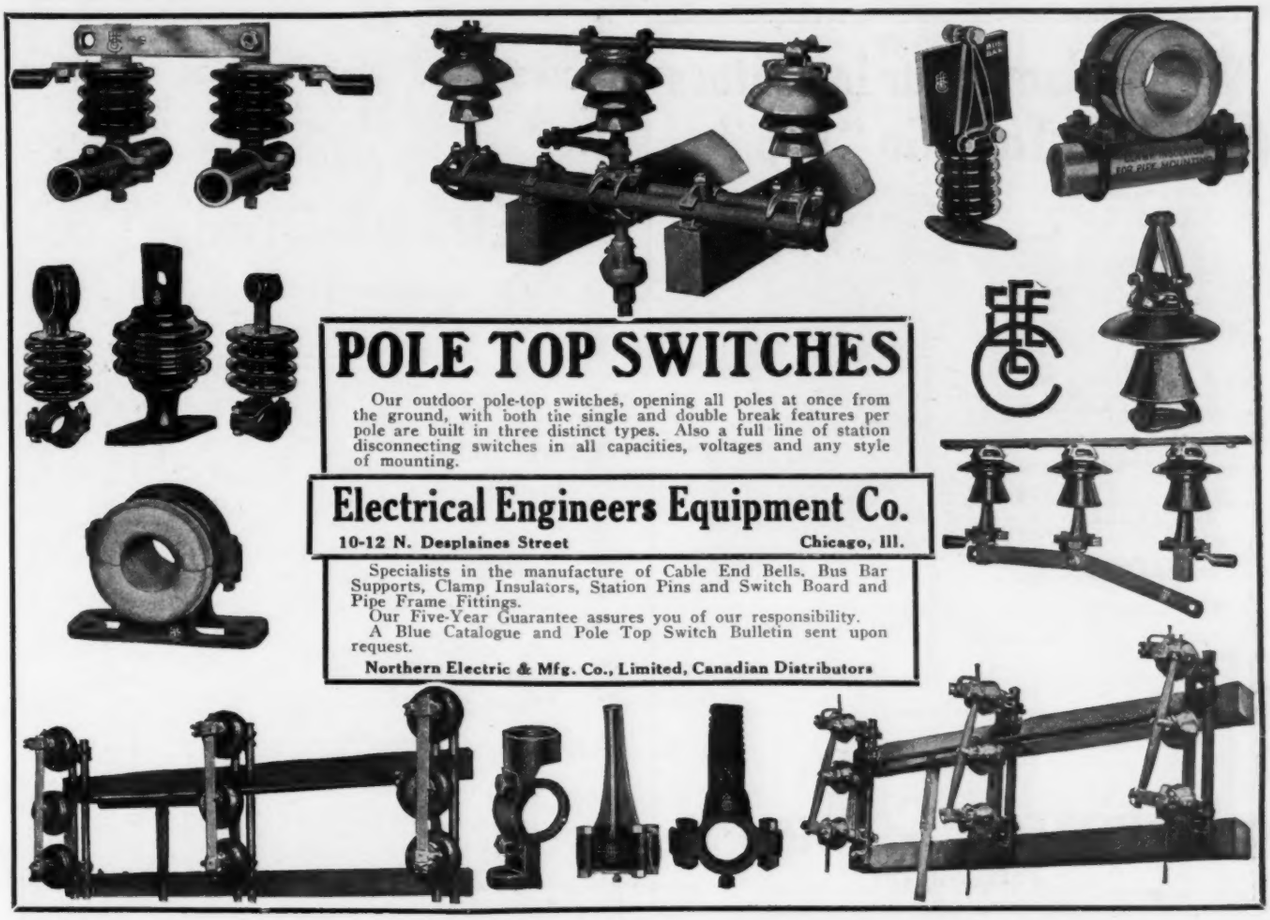

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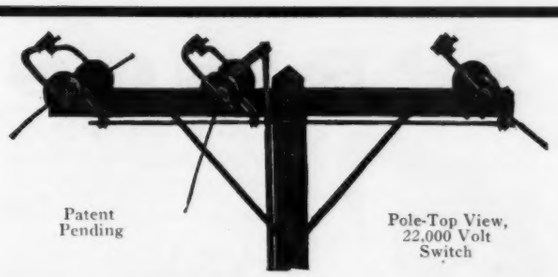

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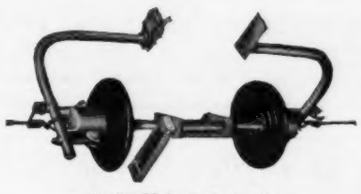

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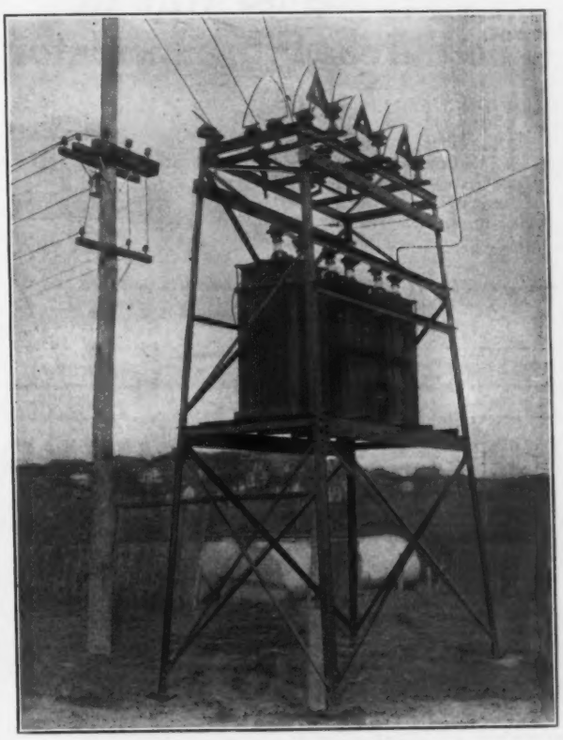

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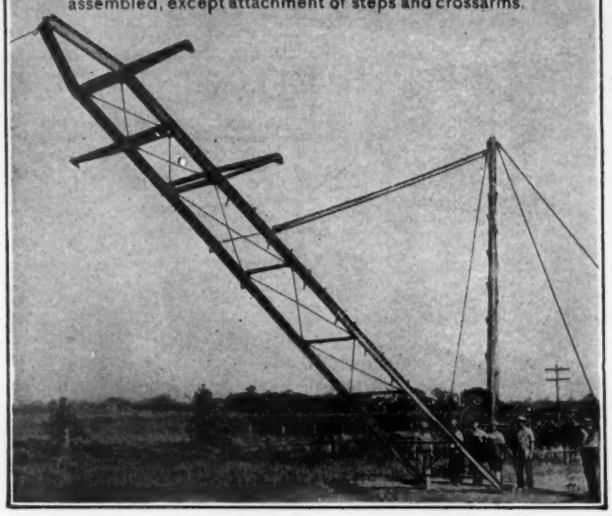

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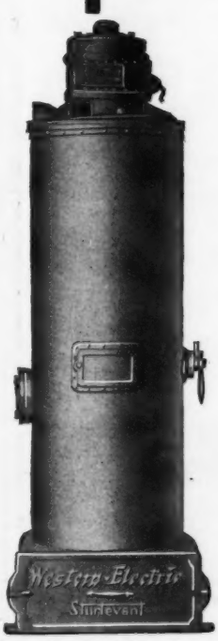

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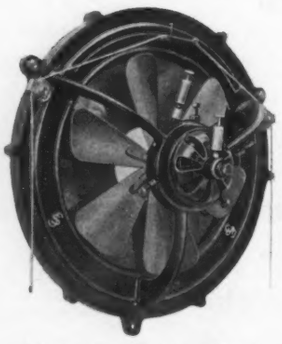

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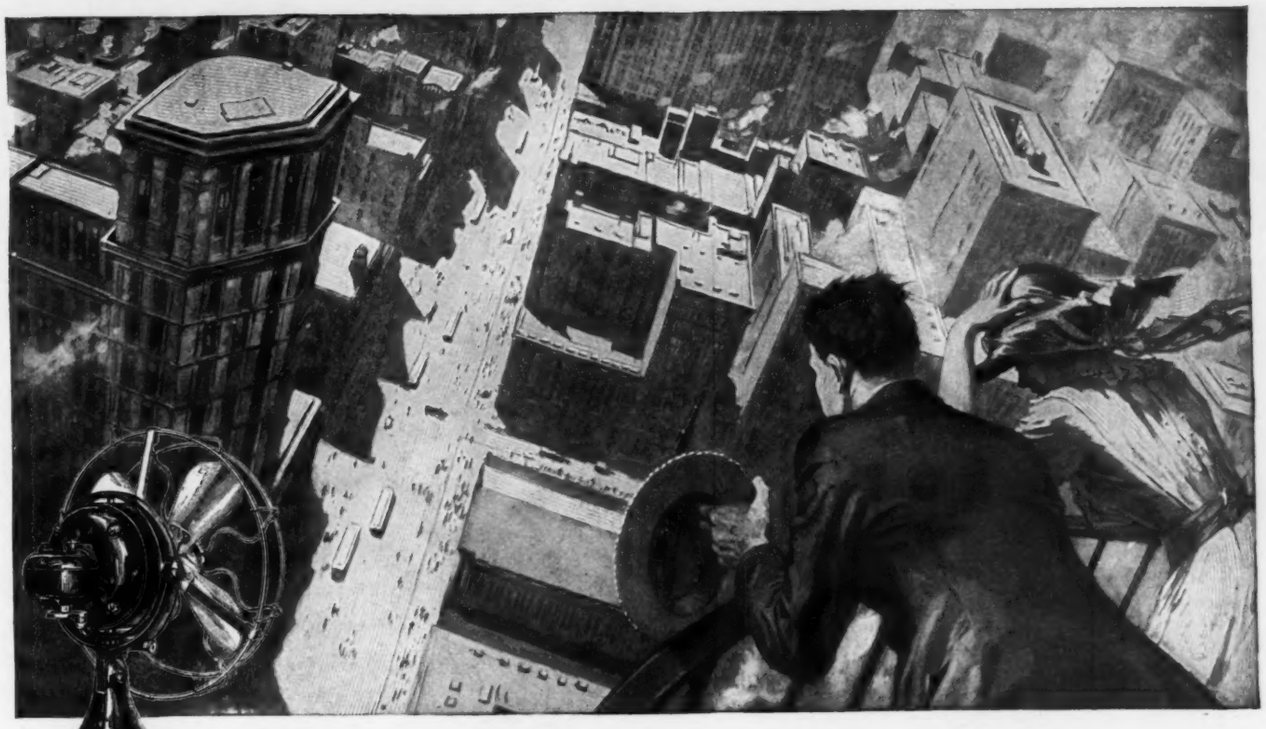
FOR INFORMATION REGARDING EXPORT, ADDRESS DR. K. C. FRANK, 90 WEST STREET, NEW YORK

The Trade Mark of the Largest Electrical Manufacturer in The World.



Down where Nature cannot send her cooling breezes Science sends the Electric Fan

This illustration and head line begin the fifth chapter of our "Use Electricity" campaign to the readers of the Saturday Evening Post and other magazines. It will appear in the issue of July 5th.

The hot weather advantages of electric service are emphasized by word and picture. In addition to featuring the many uses of G-E Fans in office and home, the advertisement describes the summer uses of G-E Flatirons, Percolators, Toasters, etc., and the way these devices can be operated in conjunction with Edison Mazda Lamps.

This July chapter of an advertising campaign reaching millions of readers monthly is but another example of the continuous co-operation enjoyed by all G-E agents and dealers.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4293

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

The Type RI Single Phase Motor

All Central Stations recognize the value of single phase power service both for out of the way places and thickly populated districts where the load is relatively small or the motor is to be installed slightly off the three-phase lines.

The RI Single Phase Motor has mechanical and electrical features which make it a profitable acquisition to the final user as well as to the power plant.

Mechanical Features

The Riveted frame construction of the motors gives small weight and bulk for a given output and speed. The compact, mechanically perfect structure exposes the outside and inside stator laminations directly to the air. Heat radiation is also augmented by internal directive fan ventilation, adding to cool running and the life of the motor.

Fig. 1.
Type RI, Four-Pole, 2 H.P., 1800 R.P.M., 60 Cycle, Form G, 110/220-Volt, Single-phase, Repulsion Induction Motor.

Cast iron bearing brackets provide a substantial "end shield" protection for stator coils. The brackets fit into a recess in the stator frame and are fastened by heavy cap screws, located by jig drilling, ensuring correct alignment as well as ease in assembly.

Enameled, cotton covered wire is used for field windings to provide against mechanical abrasion, moisture and withstand higher potentials than where ordinary double cotton covered wire is employed. These windings are placed in carefully insulated slots and are frequently dipped in insulating compounds with long intermediate bakings. These are but a few of the reasons for the long life and service reliability of RI motors.

Electrical Characteristics

Power factor 94 to 98 per cent at full load. Power factor 75 to 80 per cent at no load.

Starting and accelerating torque, 250 per cent of full load values.

Breakdown torque 275 to 300 per cent of full load value.

Efficiency well maintained in all sizes throughout the usual working range, i.e., ¾ to 1¼ load.

Write our nearest office or motor agency for literature giving complete information on the RI Single Phase Motor.

General Electric Company

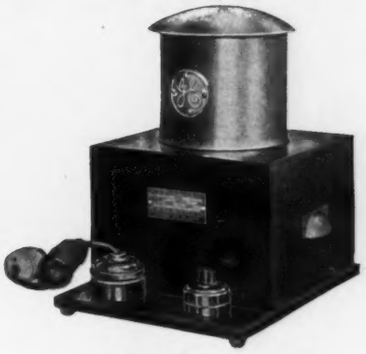
List of Sales Offices on Second Page Before Editorial Section

4263

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

Universal Ozonator



Household Ozonator

Utility Ozonator

Ozone and the Ozonator

The usefulness of ozone is now becoming generally recognized. Its most common uses are in destroying disagreeable odors and in making impure air more wholesome.

The G-E Ozonator is a highly perfected, practical device for producing ozone by means of electrical discharges.

Ozonators are now used in hotels and restaurants for destroying cooking odors. In theatres and other places where crowds gather, they materially improve the condition of the air. Their use is extending to stores, offices and homes.

G-E Ozonators have demonstrated their reliability and usefulness by a year of successful service. Progressive central stations and electrical dealers should be prepared to show the Ozonator to their customers.

G-E Ozonators are National Code Standard.

Get further information and prices from our nearest office.

General Electric Company

List of Sales Offices on Second Page Preceding Editorial Section

4078

This Trade Mark The Guarantee of Excellence on Goods Electrical.

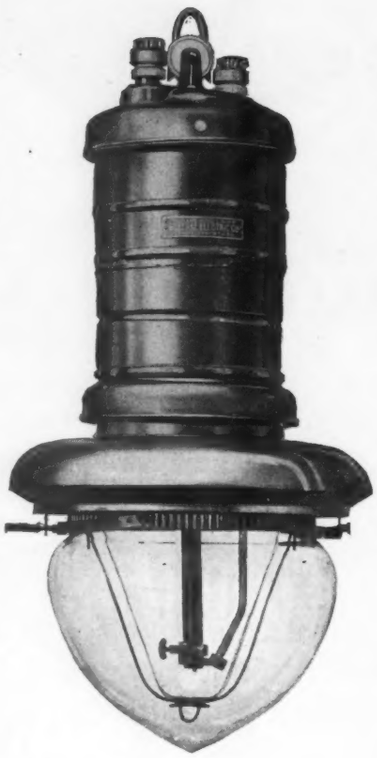
This Trade Mark The Guarantee of Excellence on Goods Electrical.

Type W Flame Arc Lamp

This lamp is the most economical and satisfactory unit for lighting large areas.

The light is powerful, steady, and very penetrating, the brilliancy remaining undiminished throughout the trim.

The maintenance cost of the lamp is low as one set of carbons burns from 100 to 120 hours without attention and only one electrode needs renewing at each trim.



A Few Installations of the Type W Flame Arc Lamp:

Pennsylvania R. R. Co.
Haskell Barker Car Co., Michigan City, Ind.
Pullman Car Works, Pullman, Ill.
Great Western Smelting & Refining Co., Chicago, Ill.
Union Malleable Iron Works, East Moline, Ill.
Corn Producers' Refining Co., Pekin, Ill.
American Steel Foundries, Indiana Harbor, Ind.
Standard Oil Co., Chicago, Ill.
Commonwealth Edison Co., Chicago, Ill.
Sanitary District, Chicago, Ill.
City of Chicago, Chicago, Ill.
St. Paul Gas Light & Power Co., St. Paul, Minn.
Omaha Electric Light & Power Co., Omaha, Neb.
Alton Gas & Electric Co., Alton, Ill.
Coon Rapids Development Co., Anoka, Minn.
American Car Foundry Co., St. Louis, Mo.
Pittsfield Elec. Co., Pittsfield, Mass.
Schenectady Illuminating Co., Schenectady, N. Y.

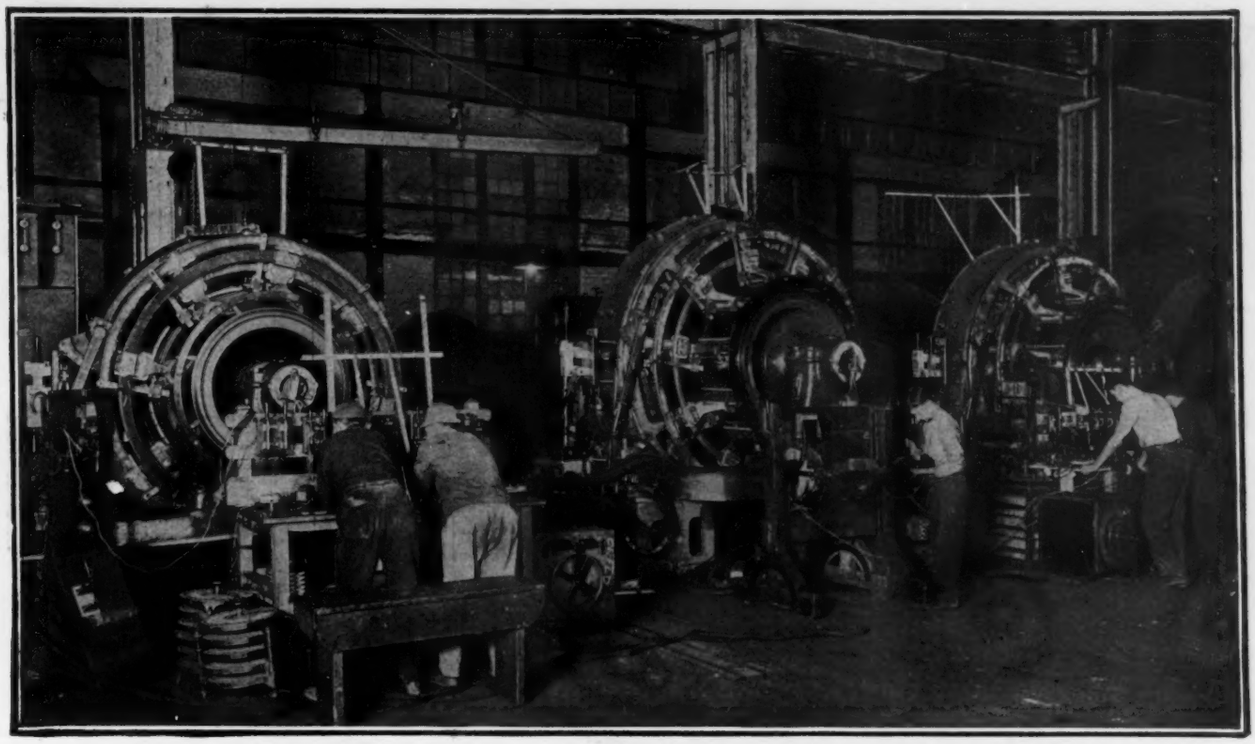
The remarkable success of the Type W Flame Arc Lamp is indicated by the thousands already in use.

Send for descriptive folder Y210.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section 4258

The Trade Mark of the Largest Electrical Manufacturer in The World.



One 1500 kw and two 2000 kw G-E Commutating Pole Rotaries on test

The G-E Test Man Will Tell You What G-E Rotary Converters Can Do

He knows that it is a daily occurrence to place one of these large rotaries under the standard guarantee test:

150% load for two hours; 200% momentary load.

And that the machines invariably operate perfectly on these loads.

Special machines for extra heavy service are guaranted as follows:

150% load for two hours; 200% load for half an hour; 300% momentary load.

Substation operators all over the country know that these guarantees are made on a conservative basis too. Twenty of the 2000 KW commutating pole rotaries have been sold during the past two years.

This type of rotary was introduced by the General Electric Company over two years ago, and many stations are now carrying enormous peakloads without starting extra machines—simply because the G-E guaranteed operation is a workable rating for every day service.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section

3902

This Trade Mark The Guarantee of Excellence on Goods Electrical.

This Trade Mark The Guarantee of Excellence on Goods Electrical.

Small Capacity Oil Switches

The smallest and lowest priced G-E Oil Switch is known as the "P-3" and is intended for use on low voltage A. C. circuits. This oil switch is widely used for controlling low voltage motors of 25 h. p. or less in cases where there is no objection to throwing the motors directly on the line.

While lever switches are sometimes used for this class of work, the oil switch has many advantages especially where inflammable dust or gas is present as in textile, flour or powder mills, woodworking plants, oil refineries, etc.

All Live Parts Enclosed

All live parts of this switch are totally enclosed which eliminates fire hazard and makes the operation of the switch safe in the hands of the ordinary laborer. "P-3" switches have the same "sliding wedge contact" construction used in the large "Form K" switches, but have only a single break in each phase instead of the double break found in the larger switches. For voltages of 550 or less, for which this switch is recommended, the single break gives ample rupturing capacity.

"P-3" switches are non-automatic, but where automatic tripping is desired, the "P-6" switch, of similar construction to the "P-3", can be furnished with whatever automatic tripping devices are needed.

"P-3" and "P-6" switches can be operated with shipper rods whenever this is desirable. Large numbers of these switches used for controlling spinning frame motors are operated in this way.

Bulletin A 4113 describes these switches in detail.

General Electric Company

List of Sales Offices on Second Page Before Editorial Section

4278

The Trade Mark of the Largest Electrical Manufacturer in The World.

The Trade Mark of the Largest Electrical Manufacturer in The World.

This page is prepared for the ready reference of the readers of the Electrical World. To insure correspondence against avoidable delay, all communications to the company should be addressed to the sales office nearest the writer.

General Electric Company

Sales Offices

ATLANTA, GA., Third National Bank Building.
BALTIMORE, MD., Electrical Building.
BIRMINGHAM, ALA., Brown-Marx Building.
BOISE, IDAHO, Idaho Building.
BOSTON, MASS., 84 State Street.
BUFFALO, N. Y., Electric Building.
BUTTE, MONTANA, Electric Building.
CHARLESTON, W. VA., Charleston National Bank Bldg.
CHARLOTTE, N. C., Commercial National Bank Bldg.
CHATTANOOGA, TENN., James Building.
CHICAGO, ILL., Monadnock Building.
CINCINNATI, OHIO, Provident Bank Building.
CLEVELAND, OHIO, Citizens Building.
COLUMBUS, OHIO, Columbus Savings & Trust Bldg.
DAVENPORT, IOWA, Security Building.
DAYTON, OHIO, Schwind Building.
DENVER, COLO., First National Bank Building.
DETROIT, MICH., Dime Savings Bank Bldg. (Office of Agent)
ELMIRA, N. Y., Hulett Building.
ERIE, PA., Marine National Bank Building.
INDIANAPOLIS, IND., Traction Terminal Building.
JACKSONVILLE, FLA., Florida Life Building.
JOPLIN, MO., Miners' Bank Building.
KANSAS CITY, MO., Dwight Building.
KEOKUK, IOWA, Monarch Building.
KNOXVILLE, TENN., Bank & Trust Building.
LOS ANGELES, CAL., 124 West Fourth Street.
LOUISVILLE, KY., Paul Jones Building.
MEMPHIS, TENN., Randolph Building.
MILWAUKEE, WIS., Public Service Building.
MINNEAPOLIS, MINN., 410 Third Ave., North.
NASHVILLE, TENN., Stahlman Building.
NEW HAVEN, CONN., Malley Building.
NEW ORLEANS, LA., Maison-Blanche Building.
NEW YORK, N. Y., 30 Church Street.
OMAHA, NEB., Union Pacific Building.
PHILADELPHIA, PA., Witherspoon Building.
PITTSBURG, PA., Oliver Building.
PORTLAND, ORE., Electric Building.
PROVIDENCE, R. I., Union Trust Building.
RICHMOND, VA., Mutual Building.
ROCHESTER, N. Y., Granite Building.
SALT LAKE CITY, UTAH, Newhouse Building.
SAN FRANCISCO, CAL., Rialto Building.
SCHENECTADY, N. Y., G-E Works.
SEATTLE, WASH., Colman Building.
SPOKANE, WASH., Paulsen Building.
SPRINGFIELD, MASS., Massachusetts Mutual Bldg.
ST. LOUIS, MO., Wainwright Building.
SYRACUSE, N. Y., Onondago County Savings Bank Bldg.
TOLEDO, OHIO, Spitzer Building.
WASHINGTON, D. C., Evans Building.
YOUNGSTOWN, OHIO, Wick Building.

For TEXAS, OKLAHOMA and ARIZONA Business refer to Southwest General Electric Company (formerly Hobson Electric Co.)
DALLAS, TEX., 1701 N. Market Street.
EL PASO, TEX., 500-2 San Francisco Street.
HOUSTON, TEX., 1114 Franklin Street.
OKLAHOMA CITY, OKLA., Insurance Building.

FOREIGN SALES OFFICES

SCHENECTADY, N. Y., Foreign Dept.
NEW YORK, N. Y., 30 Church St.
LONDON, E. C., ENGLAND, 83 Cannon St.

For all CANADIAN Business refer to
CANADIAN GENERAL ELECTRIC CO., LTD., Toronto, Ont.

General Offices, Schenectady, N. Y.

Edison Lamp Department, General Sales Office, Harrison, N. J.

Products and Purpose

The General Electric Company is the largest electrical manufacturer in the world. With few exceptions its products comprise every kind of apparatus and machinery used in the generation, transmission, distribution and use of electrical energy. Its thousands of products, in use in all parts of the world, have established the G-E Trade-Mark as the Guarantee of Excellence on Goods Electrical. As in the past the General Electric Company will continue to be foremost in all developments and improvements tending toward the perfecting of present electrical service and its extension into new fields of usefulness.

3810

This Trade Mark The Guarantee of Excellence on Goods Electrical.

KERITE

BE
GUIDED
by facts, not theories—
by performance records, not claims—
by experience, not prophecy. Every
consideration points straight to KERITE
for permanently satisfactory and economical service.

KERITE INSULATED WIRE & CABLE COMPANY
General Offices: 30 Church Street, New York Western Office: Peoples Gas Building, Chicago
Lillibridge 80145

WEBER UNIVERSAL SOCKETS

KEY
KEYLESS
PULL
} INTERCHANGEABLE {
FIXTURE
PENDENT
WALL

All Shells Fit all Caps and Bases

SIMPLE—SECURE
SUBSTANTIAL

Always Specify **WEBER UNIVERSAL** Accept No Substitutes

For sale by
ALL JOBBERS OF ELECTRICAL SUPPLIES

Henry D. Sears, General Sales Agent, 131 State St., Boston, Mass. 3

OKONITE

TRADE MARK REG. U.S. PAT. OFF.

The STANDARD for RUBBER INSULATION

OKONITE *QUALITY*

is definite—dependable, and has taught users to expect and exact a high standard of service performance.

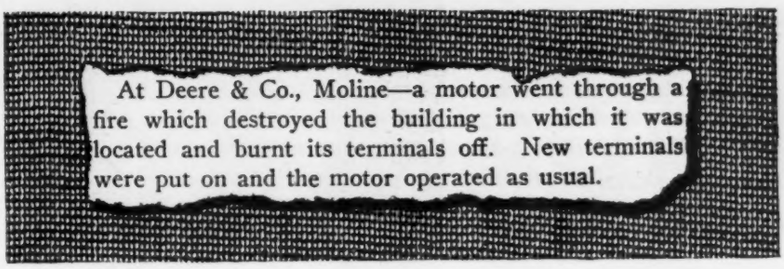
OKONITE Insulated Wires and Cables are made in but one grade—the BEST.

THE OKONITE COMPANY

253 Broadway, New York

CENTRAL ELECTRIC COMPANY, Chicago, General Western Agents
F. D. Lawrence Electric Co., Cincinnati O.—Novelty Electric Co., Philadelphia, Pa.
Pettingell-Andrews, Boston, Mass..

THE PUBLISHER'S PAGE


At Deere & Co., Moline—a motor went through a fire which destroyed the building in which it was located and burnt its terminals off. New terminals were put on and the motor operated as usual.

The Lesson Taught By A Fire

The above clipping was taken from an advertisement of the General Electric Company which appeared in a recent issue of the Electrical World.

It mentions a plant of which the superintendent happens to be a subscriber for the Electrical World and tells his experience to show that the advertiser's claims were conservative.

The advertisement stated that no guarantee is given against damage by fire, but that such tests speak well for the insulation. Surely this is true conservatism.

These facts emphasize the confidence which may be placed in statements made by Electrical World advertisers, their conservative attitude and their appreciation of the importance of helping to solve the problems of World readers.

CONDENSITE

The Ideal Molded Insulation where Quality is the First Consideration.

Molded Condensite tests in dielectric strength up to 420 volts per mil in a thickness of 225 mils.

It is unaffected by weather or strong solvents.

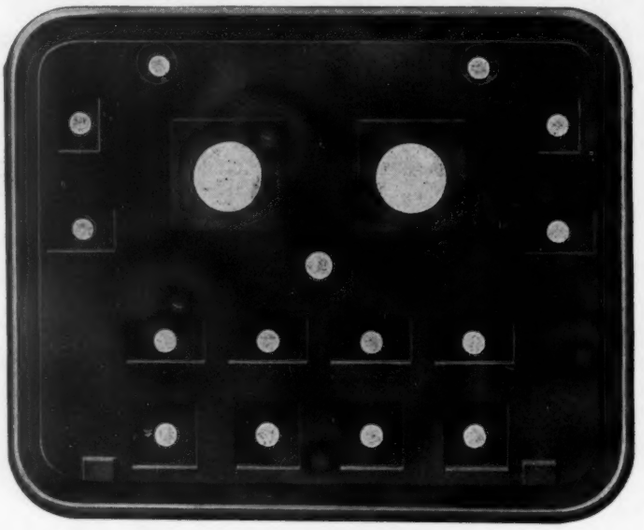
It will not soften under heat.

Tensile strength, 5000 lbs. per square inch of cross section; crushing load 25,600 lbs. per square inch.

It is harder than ivory and will take and keep a finish like burnished metal.

Ask for descriptive pamphlets.

The names of molders of Condensite will be furnished to interested parties upon request. We do not do any molding ourselves, but furnish Condensite to the molding trade in a condition ready to mold and requiring no compounding or preparation.



Condensite Company of America

GLEN RIDGE NEW JERSEY

We Put the Best in "Deltabeston"

Magnet Wire—the best copper we can buy—the best asbestos—the best workmanship.
We put the asbestos through a process which removes practically all impurities.
Then this pure fibre, impregnated with our own compound, is applied to the wire by special machinery.
That is why "Deltabeston" coils will not burn out under heavy overloads.
Our bulletins will give you the whole story—ask for them.

DELTABESTON WIRE REG. U.S. PAT. OFF.

D & W FUSE COMPANY, PROVIDENCE, R. I.

Roebling Magnet Wire

consists of specially drawn and annealed copper wire, soft and true to gauge, covered with a smooth and uniform insulation. Furnished round, flat, square and in strands.

John A. Roebling's Sons Co.

Trenton, N. J.

Friction Tape No. 264 M.C.

The right tape for all-round use. Grippy, tough, — everlasting fabric.

No pinholes; can't weaken with age; won't stick to the hands, just suited to extreme heat or cold.

Remember that more No. 264 Friction Tape is used than any other kind ever made.

Massachusetts Chemical Co.
LIQUID AND RUBBER INSULATION
Walpole, Mass.

Canadian Company
WALPOLE RUBBER COMPANY, Limited
Montreal, P. Q.

Pioneers in Insulation Engineering

The Heating Question

and its relation to

"Nichrome"

Seventh

"Nichrome" is used in standard devices which are guaranteed unqualifiedly. Now then, Mr. Manufacturer, what does this fact mean to you?

DRIVER-HARRIS WIRE CO.
Main Office and Works Harrison (Newark) N. J.
Western Branch, Chicago, Ill.
Washington Blvd. and Jefferson St.

PARANITE

Rubber Covered Wires and Cables

are made for Underground, Submarine, and Aerial Electric Light and Power Service, and for Telephone, Telegraph, Fire Alarm and Signal Work.
They conform in every respect to the requirements of the New Code Specifications. Best results will be secured if you confer with us before placing your order for wires or cables.

INDIANA RUBBER & INSULATED WIRE CO.
JONESBORO, IND.

FIELD COILS SOLENOIDS ELECTRO MAGNETS

THE ACME
WIRE COMPANY

NEW HAVEN
CONNECTICUT

The Enamel Doesn't Crack on Bending

That's one of the important advantages of

American Enameled Magnet Wire

Other advantages are: Will not flake off with temperature rise; resists abrasion; has high dielectric strength; has high ohmic resistance; is impervious to moisture; is unaffected by ordinary acids; comes in sizes 14 to 40, B and S gauge. We can give you prompt shipments.

AMERICAN ENAMELED MAGNET WIRE CO.
Muskegon, Mich.

1

ALUMINUM
ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

Aluminum Company of America
PITTSBURGH, PA.

Sales Offices: New York, Boston, Chicago, Cleveland, Detroit, Philadelphia, Rochester, N. Y.

7

Magnet Wire
SILK — COTTON — ENAMEL

PROMPT SHIPMENTS
From Our Warehouses Throughout the Country

Ask to Have Stock Card Sent You

ALFRED F. MOORE
200 N. Third Street **Philadelphia**
New York Cleveland Chicago
Boston Birmingham Chattanooga

The American Brass Co.
BENEDICT & BURNHAM BRANCH
Successors to
THE HOLMES, BOOTH & HAYDENS CO.
WATERBURY, CONN.

SUPERIOR WEATHER PROOF "K.K." TRADE MARK ELECTRIC WIRES

Manufacturers of
"K.K." Weatherproof Wire and Cable
Bare Copper Wire and Cable
Slow Burning Weatherproof Office Annunciator and Magnet Wire

NEW YORK OFFICE
99 John Street

WIRES
C O R D S

Show Window Cord Lamp Cord
Lowell Insulated Wire Co.
Lowell, Mass.
Electric Light Wire Telephone Wire

ROME WIRE CO.
ROME, N. Y.

NEW SPECIFICATION
RUBBER COVERED CODE WIRE
TELEPHONE WIRE MAGNET WIRE
BARE AND TINNED-COPPER WIRE

ORIGINAL VULCANIZED FIBRE

Send us your orders and requests for quotations for
Sheets, Cord Adjusters, Switch Bars, Rods, Magnet Spools, Switch Bases, Tubes, Cleats for Wiring, etc., Saddle Staples, Gears, Switch Handles, Washers, Gear Blanks, Controller Handles, Discs and other special shapes.

Send us your blue prints, sketches, gauges or samples of special machined parts to be made from *Vulcanized Fibre*, and we will fill your orders or quote you, making reasonable prices, and promising you a high standard of accuracy in the work.

AMERICAN VULCANIZED FIBRE CO.
Wilmington, Del.

MAGNETS
of
All Types

We furnish highest grade Magnets for use in Magnetos, Magnetic Separators, Measuring Instruments, Watt Meters, and many other purposes.

High Grade Magnet Steel

All standard sizes in stock.
Highest permeability
Breakage reduced to a minimum.
Sufficiently soft to stamp or tool without Magnetic Deterioration.

Hermann Boker & Company
101-103 Duane Street
New York

HEMMING INSULATION
GUMMON (EG) HEMIT

STANDARD

Heat-Resisting Molded Insulation. Made by specialists exclusively devoted to solving your molding problems.

Why not profit by our experience

HEMMING MANUFACTURING CO.
GARFIELD, NEW JERSEY

Insulating Machinery

BRAIDING, TAPING, WINDING, TWINING, CABLING, STRANDING, POLISHING AND MEASURING MACHINES, CABLE COVERING BRAIDERS.

FINE CASTINGS A SPECIALTY

NEW ENGLAND BUTT COMPANY
403 PEARL STREET, PROVIDENCE, R. I., U. S. A.
(2)

Are you on the lookout for the best magnet wire? Then

Massachusetts MAGNET WIRE

is what you want. The materials and labor that go into it are the best on the market.

Massachusetts Electric Mfg. Co.
WEST LYNN, MASS.

WINDING MACHINERY
FOR INSULATING WIRE
AMERICAN INSULATING MACHINERY CO.
N. W. cor Hancock and Oxford Streets, PHILADELPHIA, PA.

PLATINUM
IN ALL FORMS
FOR ALL PURPOSES
SCRAP PURCHASED
THE ROESSLER & HASSLACHER CHEM. CO.
N. Y. OFFICE 100 WILLIAM ST.
FACTORY PERTH AMBOY, N. J.

HARD PORCELAIN
For Electrical Specialties
IMPERIAL PORCELAIN WORKS
TRENTON, N. J

"Beldenamel"
TRADE MARK

is the brand of enameled magnet wire that has become a standard in many of the best electrical factories in this country.

The dielectric strength of Beldenamel is so high that the insulation specifications of the larger electrical companies are met with a wide margin of safety.

This cut shows a piece of No. 17 Beldenamel wire tightly twisted about itself without showing surface cracks or peeling. It won't break on stretching until the wire breaks. It seems incredible that such properties should be combined in an enameled surface with the hardness and smoothness of plate glass.

Beldenamel wire is used successfully to meet conditions that other makes of enameled wire have failed to meet.

Write for sample spool of any size.

BELDEN MANUFACTURING COMPANY
2300 S. Western Ave. CHICAGO

No Matter What It Is, If It's Porcelain We Make It

Send sketch or blueprint and we will quote on any desired quantity. Our slogan is, "Quality first, last and all the time."

Globe Porcelain Co., Trenton, N. J.

"INSULATE"

The Best for Quality—Finish—Price
In Stock—Many Standard Styles
Bases—Flanges—Handles, Etc.
To Order—Everything in Composition.

Facilities Large— Deliveries Prompt

GENERAL INSULATE COMPANY
1000 Atlantic Avenue, BROOKLYN, N. Y.

Canadian Amber Commutator Plate

Combination of the finest Canadian Amber Mica and Indian Lemon Shellac solution prepared under our own secret formula.
Will not flake, break or crumble when cut or punched to size and shape.
Absolutely uniform in thickness, will not ooze or sweat. Specially designed for Turbo and very large generators.
Mica for all purposes. Special Mica Mouldings.

D. JAROSLAW
19, Tower Hill, London, E. C. Cable Address: Splittings, London
Reichenbergerstrasse 79-80, Berlin So. 36 Cable Address: Glimmerite, Berlin 1

Penn New Code Wires and Cables

Made in accordance with the New National Electrical Code Rules effective January 1st, 1912.

Ask for booklet containing the new specifications.

HAZARD MANUFACTURING CO.
Wilkes-Barre, Penna.
New York—Pittsburg—Chicago

TRADE S.I.M. MARK
Insulating Specialties

25 Different INSULATING MATERIALS
and How to Use Them

Described clearly in this book which we will send you free of charge or obligation. Of great practical value. Send your name for a copy.

Standard Varnish Works
NEW YORK
Chicago, London, Berlin, Brussels, Ontario, Can.—International Varnish Co.

PLATINUM
Scrap Purchased

CONTACTS OF ALL FORMS
WIRE FOR WIRELESS TELEGRAPHY
RESISTANCE WIRE
WIRE AND SHEET FOR ALL PURPOSES
AMERICAN PLATINUM WORKS
NEWARK, N. J.

PLAS MICA
TRADE MARK

A SOLUBLE MICA
THE PLAS-MICA CO.
YONKERS, N. Y.

The Standard Insulation for repairing burnt Mica in commutators. Put up in convenient tubes. Enough for 25 ordinary repairs for $1.50. Express paid.

Better order a tube at once and be ready for an emergency.

NOTABLE BUILDINGS

Guy Lowell, Architect *Lord Electric Co., Elec. Con.*

The Boston Museum of Fine Arts

is one of the most notable art museums of this country and is wired throughout with

Simplex Caoutchouc (B. C.) Wires & Cables

This wire, which is offered to those who wish something better than Code wire, is subjected to voltage tests ranging from 100% to 185%, according to size, in excess of the Underwriters' requirements for the same thicknesses of insulation.

SIMPLEX WIRE & CABLE CO.
Manufacturers
201 Devonshire Street, Boston
CHICAGO SAN FRANCISCO
(48-60)

LINOTAPE
Is As Tough As Rubber

and equal to it electrically, while far superior in heat-resisting and "cushioning" properties.

It is cambric tape treated, by our special process, with oxidized linseed oil. Made straight and bias-cut. Look for the "Linotape" trade mark. A word from you will bring samples.

Mica Insulator Co., Originators
NEW YORK AND CHICAGO 6

Two-Way Joint Box for Steel Tape Armored Cable

Another Reason

why you should buy "STANDARD" Steel Tape Armored Cable is found in the complete line of special Joint Boxes and Terminals which we alone supply for such service. They give greater economy and increased flexibility in operation.

Write our nearest office for information.

Standard Underground Cable Co.,
Pittsburgh, Pa.
New York Philadelphia Chicago
Boston San Francisco St. Louis

ELECTRIC CABLE CO.
17 Battery Place - - - - - - New York
RUBBER COVERED WIRE
"Invincible" "Engineers," 30% Para or to any specification
Works: BRIDGEPORT, CONN.
Offices, Boston, Philadelphia, Cleveland, Chicago, San Francisco

Importers of **INDIA MICA** Direct Shipments
MEIROWSKY BROTHERS, 148 Liberty St. New York

DISFICO
DISFICO HORN INSULATION
can be pressed into any form and
Will—Not—Crack
IN ROLLS OR SHEETS
For Armature Insulation etc.
DIAMOND STATE FIBRE CO., Elsmere, Del.

Vulcanized Fibre Special Shapes
Machined to Exact Gauge
Vulcanized Fibre in Sheets, Rods and Tubes.
Bakelite—Dilecto—High Efficiency, Water Resisting Fibre.
THE CONTINENTAL FIBRE CO.
NEWARK, DEL.
CHICAGO, McCormick Bldg. NEW YORK, 26 Woolworth Bldg.

Outlet and Switch Boxes *Floor Boxes*

PROFIT By 14 Years SUCCESS

IN

MANUFACTURING AND MARKETING

TRADE BX CABLE MARK

Twin Conductors Type BX

The great mechanical strength, extreme flexibility, and rust resistant quality of the hot galvanized flexible steel armor of BX make it the most valuable material on the market for the wiring of new or old buildings.

The extreme care used by us in "testing" is your protection.

Ask for Catalog No. 4363

SPRAGUE ELECTRIC WORKS
of General Electric Company

Main Offices: 527-531 West 34th St., New York City

BRANCH OFFICES

Chicago Philadelphia Boston Baltimore Pittsburgh
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Underwriter's Tests Prove it Safest

The longest-lived, most successful of all insulation provided in

Diamond
Rubber Covered Wires and Cables

The most exhaustive underwriter's tests prove that it is longest lived and provides the largest margin of safety.

The B. F. Goodrich Company

Akron, O. Branches in all leading cities.

There is nothing in Goodrich Advertising that isn't in Goodrich Goods.

DOLPHIN
INSULATED WIRE

Manufactured with exceeding care to maintain a prestige already established.

In actual service Atlantic Insulated Wire exceeds the claims we make for it.

ATLANTIC INSULATED WIRE & CABLE COMPANY

Sales Office: 120 Liberty Street, New York
Factory: Stamford, Ct.

DOLPHIN ATLANTIC

Commercial Code (1)

THE
National Conduit & Cable Co.
Executive Offices: 41 PARK ROW, NEW YORK, N. Y.

Bare Copper Wire and Cable
Weatherproof Wire and Cable
Office and Annunciator Wire and Cable
Paper Insulated Cable
Power, Telephone, Telegraph

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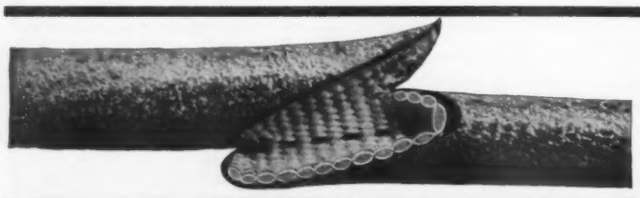
WATERBURY WIRES AND CABLES

in rubber, paper and varnished cloth insulations, lead incased and braided for power, signal, telephone and all other electrical requirements.

SUBMARINE CABLES

Quotations promptly furnished.

WATERBURY COMPANY
80 South Street, NEW YORK



Specify DURADUCT
Single Inseparable Wall — Cannot Blister

TUBULAR WOVEN FABRIC CO. - - Pawtucket, R. I.

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Of Silicon Alloy Steel, Patented. Highest grade Electrical Sheets manufactured for transformers, dynamos and motors; insuring minimum heating, maximum capacity, non-aging. Other standard sheets are American Armature, U. S. Electrical, and Pole Face. Write for full information.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh

AMERICAN SHEET & TIN PLATE CO. APOLLO SPECIAL ELECTRICAL TRADE MARK REGISTERED PITTSBURGH

ORDINARY specifications may describe a wire or cable which will afford safety under ordinary conditions. But it is a matter of bitter experience that failure and loss usually result from unexpected, emergent conditions. Hence the necessity, in the interest of absolute security, for a margin ample beyond anticipated demands. This is one of the foundation stones of "Safety" manufacturing methods. When specifications are laid before us, we interpret them in the broadest, rather than in the narrowest, sense. We frequently point out where specifications are weak or inadequate. And we make our quotations upon a basis of a most liberal interpretation of the buyer's wishes. We aim to make Safety Insulated Wires and Cables rather better than most other manufacturers think necessary—better, in fact, than most manufacturers can produce.

SEAMLESS RUBBER SAFETY INSULATIONS

SAFETY INSULATED
WIRE & CABLE CO.
114 LIBERTY ST., NEW YORK
CHICAGO BOSTON
SAN FRANCISCO

No. SIW-9

The Labor Saved in Conduit Fishing

will, in only a few months, pay for the

Pneumatic Conduit Fisher

It works perfectly in cases where it is absolutely impossible to get a fish-wire through the conduit.

It does its work in a few seconds, regardless of the length of the conduit or the number of elbows or offsets.

And it effects a labor-saving of from 75 to 90 per cent.

Ask us to tell you all about it.

Demonstration at No. 40 Murray Street, New York City

Pneumatic Conduit Threader Co., Inc.
12 N. 8th Street **Richmond, Virginia**

Collets on Dies Are Unnecessary

for true clean thread cutting when

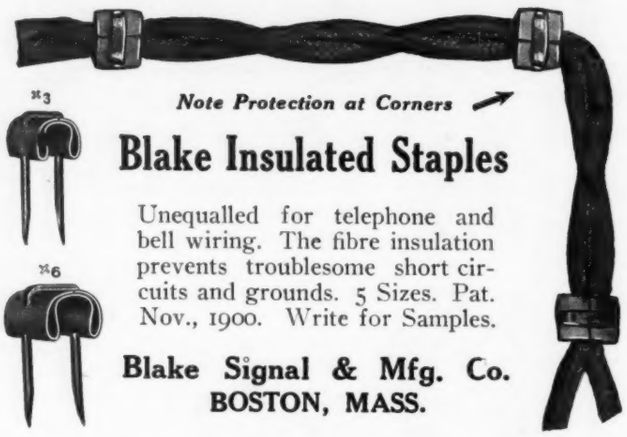
Carpenter's Adjustable Dies

TRADE MARK C Registered

are used in **Carpenter's Adjustable Stock.** Standard for over 43 years.

Ask for complete catalog. 1

The J. M. Carpenter Tap & Die Co., Pawtucket, R. I.



Blake Insulated Staples

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds. 5 Sizes. Pat. Nov., 1900. Write for Samples.

Blake Signal & Mfg. Co.
BOSTON, MASS.

Universal Cable Grips

ARE ADAPTED TO ALL CLASSES OF AERIAL AND UNDERGROUND CONSTRUCTION

THIS IS IT—THE ONE DOLLAR DRIVE ANCHOR

A UNIVERSAL RED-TOP

A UNIVERSAL RED-TOP

WRITE FOR 1913 CATALOG AND PRICE LIST.

Universal Cable Grip Company
Manufacturers of
Specialty Construction Tools and Appliances
Syracuse, N. Y., U. S. A.

"AMERICAN"

Bituminized Fiber Conduit

7 Foot Lengths. 3/16 Inch Walls. 5/16 Inch Joints.

Compare These Figures with Other Types:
Absorption, 100 Hrs, 3/4 of 1%. Puncture Test, 50,000 V.

American Conduit Company
East Chicago, Ind. **140 Nassau St., New York**

American Vitrified Conduit Co.

Flatiron Building, NEW YORK

Manufacturers of High-grade Single and Multiple Vitrified Salt Glazed Clay Conduits.

Edward H. Smith

Underground Construction, Cable Pulling, Splicing and Subway Building

10115 N. BOULEVARD **CLEVELAND, O.**

Superior

POLE LINE MATERIAL

We can furnish any quality of arms, pins, brackets, or pole line hardware you call for if you can wait for factory shipment, but stock only

Superior

which carries our guarantee. This includes:

Washington Fir, not less than 85% heart,
Georgia Pine—Long Leaf—not less than 75% heart,
Spruce—Kyanized,
Pins and Line Hardware, A T & T specifications.

STUART-HOWLAND CO.
131 to 141 Federal St., Boston

G. M. Gest

Conduit
Engineer & Contractor

Executive Offices
277 Broadway
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Cincinnati *San Francisco*
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The Real Quality

INSULATED REGISTERED I.X.L. U.S. PATENT OFFICE WIRES

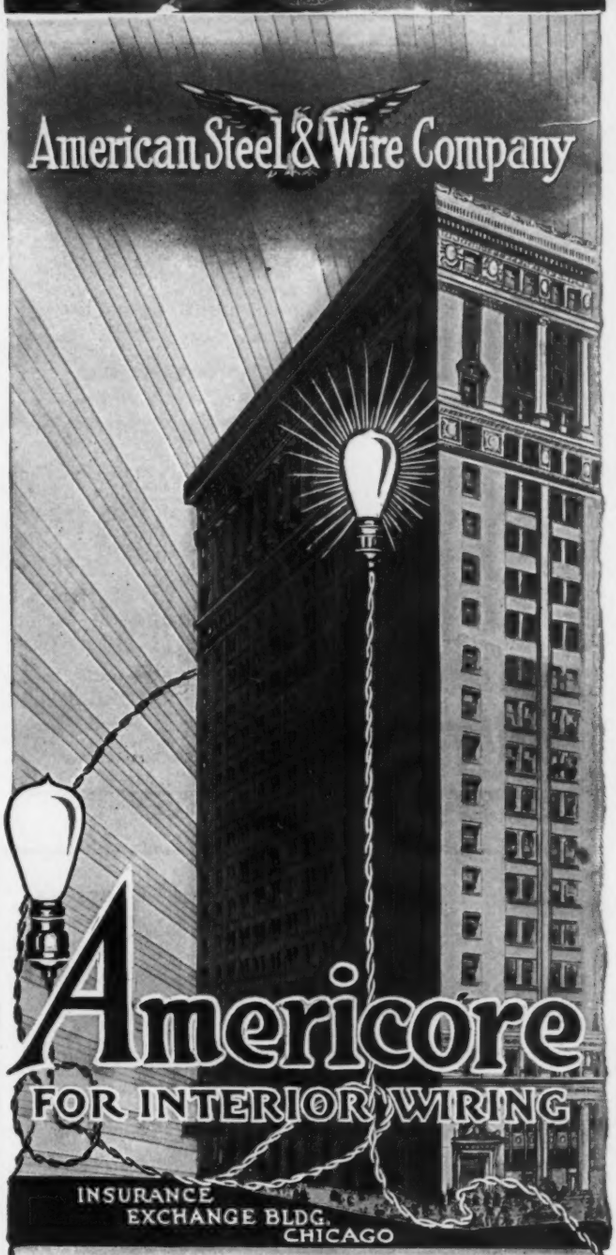
Collyer

I. X. L. Brand

Weatherproof, Slow Burning and New Code Rubber Covered Wire and Lamp Cord, Annunciator and Office Wire. Get our quotations.

Collyer Insulated Wire Co., - Pawtucket, R. I.

American Steel & Wire Company



OVER 200,000 feet of our Americore rubber covered wire used in this building.

Every foot is carefully inspected by us in the various stages of manufacture, and when completed is finally examined and labeled under the direction of the Underwriters' Laboratories.

We are prepared to furnish this wire in all sizes and conductors, both solid and flexible, from warehouses conveniently located for quick delivery to all parts of the country.

Chicago **New York** **Cleveland**
Worcester **Pittsburgh** **Denver**

Guaranteed Without Reservations

"SIEMENS" Flaming Arc Lamps

"The Lamps that make good"

An intense white or yellow light, on A. C. or D. C. circuits.

Trim life 10, 20 or 40 hours. Ready for immediate delivery.

Guaranteed absolutely by the makers, Siemens-Schuckertwerke, Berlin. Guaranteed *again* by

The H. M. Hirschberg Company
H. M. Hirschberg, President
Established 1905.
39 East 20th Street, New York

Branches:
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1

A Real Lamp

"Excello"

Model 197

is known everywhere to be absolutely reliable in operation and to distribute a greater volume of light with less electrical energy than any of the present flame types.

The "Excello" is not an experiment, but is a **Real Asset** with the least depreciation after **eight years'** constant service without any necessary changes in its construction.

Experiments are Expensive. "Excello" is foolproof, likewise "Excello" Carbons.

Write for further information and prices.

KOERTING & MATHIESEN CO.
22 East 21st Street, New York
CHICAGO: 160 N. Fifth Ave.

Equip All Your Arcs And Mill Clusters With the

Thompson Automatic Safety Cut-Out Hanger

which will enable the trimmers to automatically cut each lamp out of circuit and lower it *to the ground* for cleaning or trimming. There is no danger to trimmer or equipment from shock or short circuit. Trimming is done in half the time, and the

Lamps Give Better Light

because they are properly cleaned and cared for. The lamps can be placed wherever they will light the space to best advantage — the Thompson Hanger makes them accessible, wherever located.

There are at present two sizes of Thompson Hangers: The "Regular," for multiple arcs and the "Baby" for mill clusters and tungstens.

Ask for new catalog and list of prices.

The Thompson Electric Co.
CLEVELAND · OHIO

2

The Drawn Wire

FLEXILUX
Continuous Filament
TUNGSTEN LAMPS

It's Tough, Durable and Efficient. Made in all sizes. Get our prices.

LUX MANUFACTURING COMPANY
50-52-54 Grove Street
Tel. 2151-2152 Spring New York City

SAMSON Spot Cord

Trade Mark Reg. U. S. Patent Office.

For Hanging Arc Lamps

Far outlasts any other cord on the market. Honest cotton, thoroughly waterproofed. Will not short circuit or cut the hands. Write for samples.

Samson Cordage Works
BOSTON, MASS.

To Save 33 to 50 per cent And Get Better Service, String Your Transmission Line With

Copper Clad Steel Wire

A No. 10 B & S copper wire with a breaking weight of 489 pounds has an elastic limit of ONLY 160 POUNDS, and after being subjected to a load beyond its elastic limit does not return to its original tautness. It will retain the sag caused by the stretching and grow worse under each additional strain until it finally breaks.

Compare this with No. 12 B & S Copper Clad, which has a breaking weight of 510 pounds and an elastic limit of 250 POUNDS.

Its smaller diameter prevents the accumulation of as heavy a sleet load as the No. 10 copper, its decreased weight is easier on your poles and cross arms, while its mechanical superiority insures a line that's in service ALL THE TIME.

And similar comparisons hold true throughout the entire range of commercial sizes.

Copper Clad wire is ideal for any service where you need the conductivity of copper and the strength of steel. The two metals are joined by the only copper-to-steel weld known to the metal-working art.

The Copper-Clad Booklet goes into detail. Ask for it.

No. 12 B & S Copper Clad Wire
Breaking Weight, 510 lbs.
Elastic Limit, 250 lbs.

No. 10 B & S Copper Wire
Breaking Weight, 489 lbs.
Elastic Limit, 160 lbs.

TRADE-MARK
"WELD CLAD"

DUPLEX METALS COMPANY

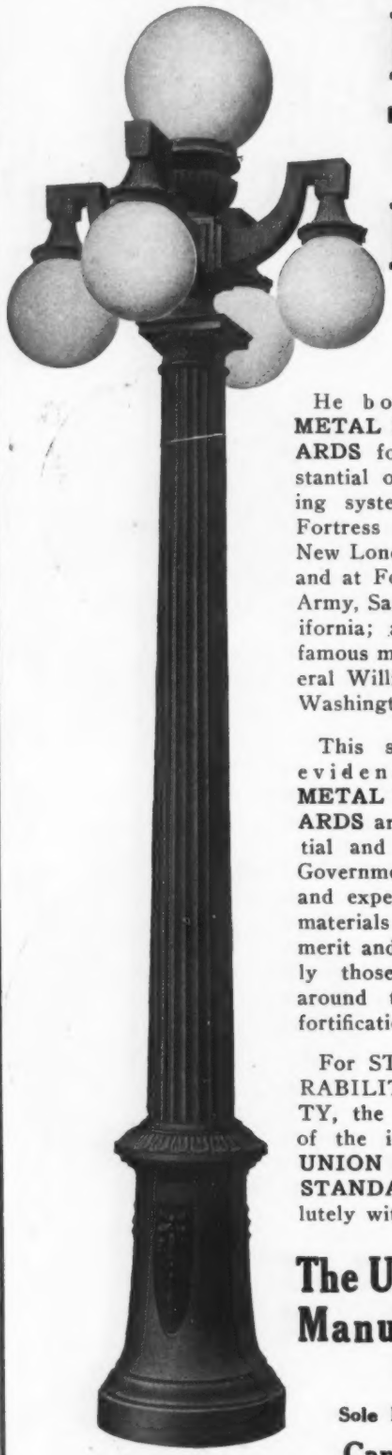
CHESTER, PENNSYLVANIA

CHICAGO OFFICE
853 Peoples Gas Building

NEW YORK OFFICE
30 Church Street

GRIPPER AND SIDE GUIDE

"Uncle Sam Buys The Best"



He bought **UNION METAL LAMP STANDARDS** for his fine, substantial ornamental lighting systems installed at Fortress H. G. Wright, New London, Connecticut, and at Fort Mason, U. S. Army, San Francisco, California; also around the famous monument of General William T. Sherman, Washington, D. C.

This should be some evidence that **UNION METAL LAMP STANDARDS** are really substantial and artistic, as the Government Engineers and experts always exact materials of unquestioned merit and value—especially those used in and around the Government fortifications.

For STRENGTH, DURABILITY and BEAUTY, the prime requisites of the ideal lamp post, **UNION METAL LAMP STANDARDS** are absolutely without a rival.

Design No. 75-R

The Union Metal Manufacturing Co.

Sole Manufacturers

Canton, Ohio

Sales Representatives

New York City, W. L. Fairchild, 30 Church St.

San Francisco, Calif., Pacific States Electric Co.

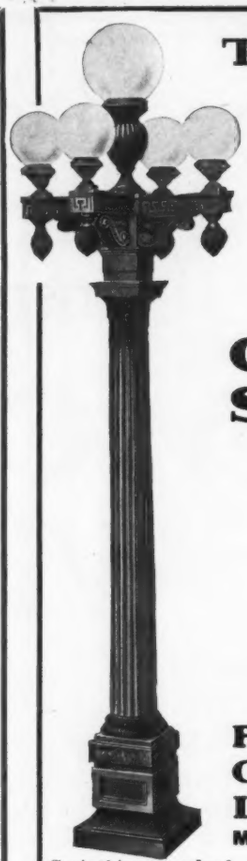
Portland, Ore., Pacific States Electric Co.

Seattle, Wash., Pacific States Electric Co.

Winnipeg, Canada, Frank E. Filer Co.

Syracuse, N. Y., Scranton, Pa., Syracuse Supply Co.

Los Angeles, Calif., Pacific States Electric Co.



The Beauty of Utility

and the Utility of Beauty have never been so forcibly illustrated as in our catalog of

Corinthian Standards

Get your copy and you will be able to study to exact scale the most artistic and durable standards obtainable.

FLOUR CITY ORNAMENTAL IRON WORKS

Minneapolis Minn.

Corinthian Standard Patented

Western Electric Co., Selling Agents Offices in All Principal Cities

The Phenixlite

Try it for better illumination. Ask for Catalog.

The Phoenix Glass Co., New York

Here Is Where They Are Made

AGENTS

Independent Lamp & Wire Co., 11-17 S. Desplaines Street, Chicago, Ill.
Hendee Connor Company, 38 W. Seneca Street, Buffalo, N. Y.
W. R. Ostrander & Co., 22 Dey Street, New York City.
Wm. P. Johnson Electric Co., 13 No. 6th Street, Minneapolis, Minn.
John W. Schiffer, 707 N. Mount Street, Baltimore, Md.
Percy H. Howard, 332 Beacon Street, Somerville, Mass.
L. C. Blundin & Co., 38 So. 16th Street, Philadelphia, Pa.

6

Ba Ba Black Sheep,
Have you a Dim-a-lite?
Yes, kind sir,
I use them day and night,
One in the cellar
And one in the hall,
And one in the nursery,
That's the best of all.

Ask for special introductory offer.

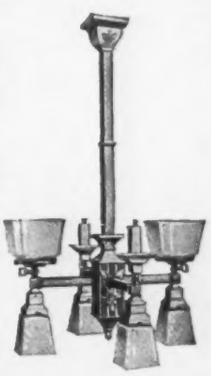
WIRT ELECTRIC SPECIALTY CO., Germantown, Phila.

Our New "Highland" Line of Electric, Gas and Combination Fixtures

The same methods as used in the manufacture of our portables will be adopted in these fixtures and when shipped they will be mechanically correct, plumb and square.

These fixtures are winners and prices low. Line includes fixtures of all kinds, Tungsten fixtures, showers and brackets.

Write for Illustrations and mention "Highland" Line.



The Goodwin & Kintz Co.
Station C, Winsted, Conn.

Benjamin Reducers

Adapt mogul screw base sockets for medium screw base lamps.
Write for our list of "Trouble Savers."

BENJAMIN ELECTRIC MFG. CO.
New York Chicago San Francisco

PLAIN AND ORNAMENTAL LIGHTING POLES

Of Every Description

Catalog "W" Mailed on request.

Electric Railway Equipment Company
N. Y. Office—90 West Street **Cincinnati, Ohio**

See our large "ad" in last issue of the "World"

INNER ARC GLOBES

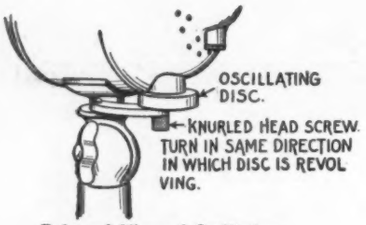
INCANDESCENT BULBS, TUBING & CANE

Write for Prices. The Lippincott Glass Co., Alexandria, Ind.

GRIPPER AND SIDE GUID

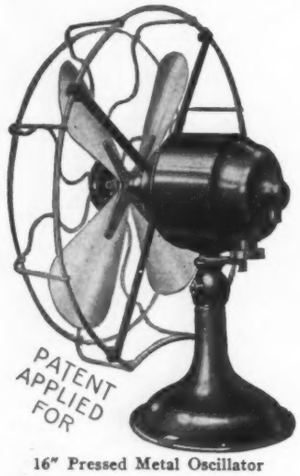
Diehl

TRADE MARK



Enlarged View of Oscillating Mechanism shown in cut below.

One twist adjusts the arc of oscillation while the fan is in motion.



16" Pressed Metal Oscillator

Diehl Pressed Metal Desk & Bracket standard and Oscillating Fans.

12" Desk & Bracket
16" Desk & Bracket
8" Desk & Bracket
12" Desk & Bracket, Oscillating
16" Desk & Bracket, Oscillating
12" Desk & Bracket, Residence Type, 6 blades.
12" Desk & Bracket, Residence Type, Oscillating, 6 blades.

Diehl Ceiling Fans

Direct and Alternating Currents. Plain and Ornamental Type. Ceiling Fans with and without Electrolier attachments. Direct and Alternating Current. Send for literature.

DIEHL MANUFACTURING CO.

ELIZABETH, N. J.

New York, Philadelphia, Boston, Chicago, St. Louis, Washington, D. C., Williamsport, Pa.

TRY THIS!

Specify Chandeliers from Beardslee's S-2 Catalog on Your Next Order

You'll find a service given on goods shown in this Catalog that's unique—superior. Service that few manufacturers try for; service that no other manufacturer attains.

Beardslee's 24-Hour Shipments

are given on chandeliers that are up to the minute in every respect; patterns that will please your most exacting customers.

Over 5,000 electrical dealers are using Beardslee's 24-Hour Shipment Catalog constantly. And every mail brings a trial order from some contractor who isn't satisfied with the service he's getting Elsewhere.

You should have this service also. Why not at once?

Beardslee Chandelier Manufacturing Co.

221 S. Jefferson St. **Chicago, Ill.**

"Delco" Chafing Dishes

are beautifully designed, and are made of heavy spun copper double tinned and finished in highly-polished nickel.

The heating unit is not permanently fixed, but is easily removable if it is necessary or desirable to use the stove for other purposes.

We have an attractive proposition for Central Stations and dealers—write for details.

Diamond Electric Company

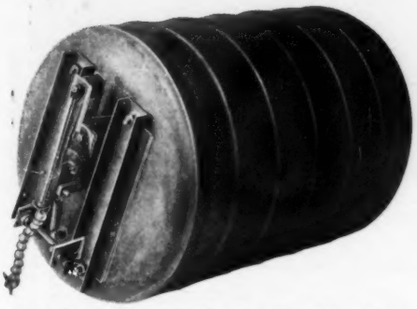
Binghamton, N. Y.

3

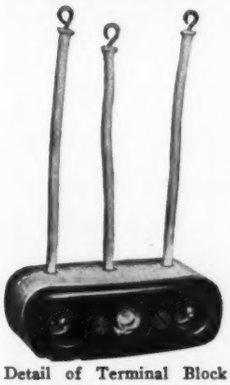
Read These Facts

Regarding the

Berkeley Automatic Electric Cooker



Welded Copper Shell Showing Heat Distributor



Detail of Terminal Block

➞ It is positively automatic in operation. It has been operated successfully for several years. This is why we guarantee it.

➞ Requires no attention. It has no adjustments—no contacts to clean.

➞ Is insulated to withstand 2300 volts.

➞ Will operate on A C or D C circuit.

➞ Heat element is nichrome ribbon—operating temperature not over 350 degrees Fahr.

➞ Heat distributor is renewable, and after expiration of guarantee will be taken in exchange for a new one with small additional charge.

➞ Flush terminal block is constructed with high insulation.

➞ THE BERKELEY ELECTRIC COOKER IS NOT AN ELECTRICAL FIRELESS COOKER. IT IS AN AUTOMATIC ELECTRIC STEAM OVEN.

➞ It is the dream of the cook for ages past—has a proper **constant** cooking temperature.

➞ COOK YOUR BREAKFAST WHILE YOU SLEEP—YOUR DINNER WHILE YOU ARE AWAY.

➞ Ask for the booklet which fully describes construction and operation.

Type C Cooker, Complete with Time Clock Attached

Berkeley Electric Cooker Co. 1932 Center St., Berkeley, California

Iron Hour Service

Do **you** realize that Simplex supremacy has come from its years of reliable service?
That this company has sold **SERVICE,** not guarantees?
That its great success has not developed from printer's ink; but from meritorious product?

Do **you** know that the faith in the integrity of electric heating devices is based on years of service given by Simplex products?

Do **you** know that 90% of the irons in laundries and manufacturing establishments (where 2000 to 3000 hours' work must be given every year) are Simplex?

Do **you** know that one year at such service equals the requirements of **ten years** of domestic service?

If **you** realize that our best references are those who have used Simplex irons for ten years or more in their business—who have used their equipment 30,000 hours and more—you can understand the value of

Simplex Iron Hour Service

SIMPLEX EQUALITY

Simplex Electric Heating Company

Mfrs. of Everything for Electric Cooking and Heating

Cambridge, Mass.

15 South Desplaines St., Chicago
612 Howard St., San Francisco
Belleville, Ontario

Have you received your copy of the new *range* booklet? It points the way to freedom from kitchen drudgery and will bring good business to you.

These Big Water Rheostats

were required for a test of a large turbo-alternator for a prominent light and power company.

The advantage of making this test was knowledge gained as to just what could be expected of the machine in the way of load capacity, and the satisfaction of knowing that the machine was all that was being paid for.

If you are a large buyer, assure adherence to your specifications by purchasing subject to test. If you are a manufacturer, submit your product to us for test. If it is superior, our report will help you sell it—if inferior, you cannot afford not to know it. Write for booklets.

Electrical Testing Laboratories

80th St. and East End Ave., New York

3

It Will Do Half a Day's Ironing in an Hour

THE

SIMPLEX Ironer

Can be operated by belting from washing machine motor or by direct drive from its own electric motor. Write for literature, prices and discounts.

American Ironing Machine Co.

Federal Life Bldg. Michigan & Randolph Street Chicago

ASK FOR BULLETIN 77

and find out about this splendid machine. We make strong claims for this washer, but listen! We will ship it to any responsible dealer anywhere and permit him to examine it critically and subject it to exhaustive tests AND if he does not find it even better than represented he may return it at our expense. The **AUTOMATIC ELECTRIC WASHER** is making good in all parts of the world. It is bought by hundreds of dealers and central stations, and some of the biggest operating companies in the United States are supplying their stations with this machine because it gives the best satisfaction to their customers and the least trouble to their men. Profit and satisfaction go hand in hand where the **Automatic** is sold. Bulletin 77 tells you.

AUTOMATIC ELECTRIC WASHER CO. Newton, Iowa

1,000 K. W. More Load, With Only 200 K.W. More Transformer Capacity

That is the result secured by one Central Station with an installation of 300 Hughes electric ranges.

It was found that the stoves added little to the evening peak, thus requiring a correspondingly small increase of transformer capacity—the average consumer's monthly bill for current has never exceeded $2.50.

If *you* want to build up a bigger domestic business, write today for particulars and prices.

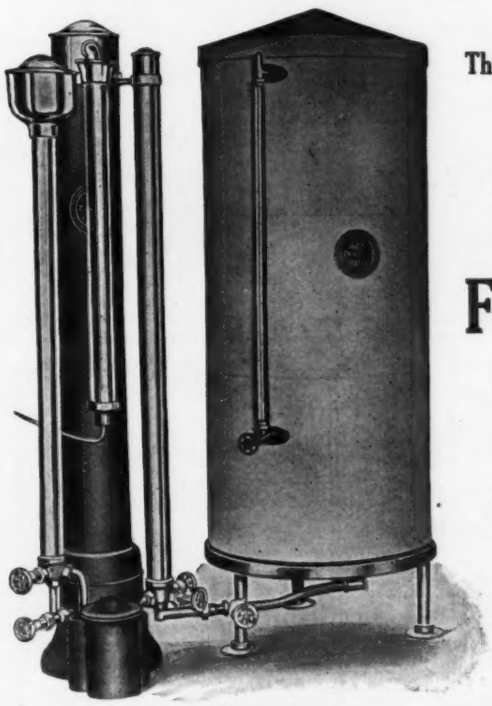
The name HUGHES stands for the best in Electric Heating Devices

Hughes Electric Heating Company

211-33 W. Schiller St. Chicago, Ill.

Factories: Chicago, Ill. and Winnipeg, Can.

Profitable Philanthropy at the Central Station



No. 1.
Catalog and prices on request.
We also make a smaller size No. 0 for household use.

That's what pointing the way to Safe Drinking Water amounts to

You safeguard the health of the community and increase your day-load. Natural water swarms with millions of disease germs—many fatal, all dangerous. Filtration merely clears the water to the sight and taste; the *live* microscopic bacilli are still there. *Boiling alone, makes water SAFE.* But *ordinary* boiling leaves it insipid.

Forbes Electric Heated Water Sterilizer

For Large Residences, Small Office Buildings and Hospitals.

Boils the water for *1c. a gallon,* and delivers it safe to drink, cool, and with all its natural, sparkling gases intact.

Connects directly with the piped water supply with no "bottle bothers." If installed on an upper floor, the STERILIZED WATER is fed by gravity; or, we can supply full automatic installations for basement. Storage capacity, 94 gallons.

Most people appreciate the vital necessity of *safe drinking water;* this feature needs no argument. When you show your customers (as you can) that, in addition to absolute healthfulness, they save 700% over "Spring" Water plus maximum convenience, sales are easy. Liberal profit on every sale aside from increased day-load.

We suggest the advisability of immediate action.

Forbes Company 1208 Callowhill Street PHILADELPHIA, PA.

In Your Own Home

That is where you really appreciate the merits of

Thor Electric Laundry Machines

The very best evidence that Thor Machines are all we say they are is the fact that they are

Used in the Households of Thousands of Electrical Men

The Central Station man and Electrical Dealer work up a lot of enthusiasm over Thor Machines, simply because they know by home experience that the Thor is a labor saving institution and a machine that delivers the goods.

We make a special trial proposition to Central Station men and Electrical Dealers on Thor Machines for their own home use.

HURLEY MACHINE CO., 29 South Clinton St., CHICAGO
New York: 1010 Flatiron Building

The Pioneers—Shelton Vibrators—The Best

Hair Dryers, Drink Mixers and other Specialties help to promote the use of electricity, and build up the day load. Ask for catalogs, prices and details of our special proposition to Central Stations and dealers.

Shelton Electric Co.
New York Chicago Boston

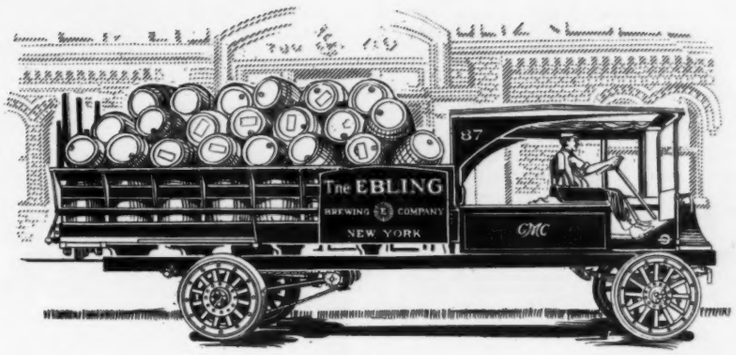
Undisplayed Cards Under Positions Wanted Cost 50 Cents for 25 Words

Keep Your Eyes on the World's Searchlight Section

Machinery Advertisements Undisplayed Cost $1.50 for 50 Words

GMC

ELECTRICS



THE EBLING BREWERY CO., NEW YORK, operates two 5-ton G. M. C. Electrics. The vehicles are used for delivering kegs and regularly cover over 50 miles on regular routes through New York and Brooklyn. Owing to the distinctive design of the machines, they are able to make this daily mileage at higher average speeds than any other electrics in similar service.

The adaptability of the electric truck to a large percentage of brewery haulage is unquestioned. It is also recognized as the logical unit for the greater part of all city and suburban delivery work.

Help carry this message to every truck user in your territory. Point the way to economical haulage by using electrics in **your own** service. And the increase in your night load will record the profit.

Use and encourage the use of electric trucks. We'll run the risk of your decision in favor of G. M. C. electrics after you've heard our story.

All GMC Trucks are Backed by the Largest Manufacturers of Motor Propelled Vehicles in the World

GENERAL MOTORS TRUCK COMPANY

PONTIAC **MICHIGAN**

Makers of Gasoline and Electric Trucks of all Capacities

Branches—New York Boston Philadelphia Detroit Chicago Kansas City St. Louis

GMC

The use of *Century*

Single Phase Motors

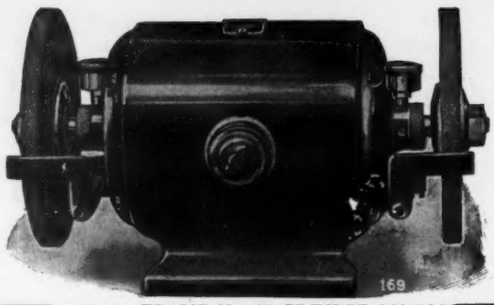
for the operation of pumps of various kinds has increased to an abnormal extent, due entirely to the heavy starting torque they develop with low starting current, their adaptability to remote or automatic control by any suitable means of closing the circuit and the continued satisfaction which they give under direct and gear drive with frequent overloads and limited attention.

¼ to 40 H. P.
25 to 140
Cycles

CENTURY ELECTRIC CO.

New York Office:
HUDSON TERMINAL
30 Church St.

Main Office and Works:
19th and OLIVE STS.
St. Louis, Mo.



SPECIAL FRAME No. 36 GRINDER MOTOR

Special Motors for Grinding and Polishing

While the motor illustrated above is intended for comparatively light grinding and polishing work, we can furnish heavier types for tool grinding, automobile buffing, polishing silverware used in hotels, restaurants, etc., or for use in machine and repair shops. We also manufacture motors for dental lathe and jewelry work. Write for bulletins and information.

Robbins & Myers "STANDARD" Motors

Our complete line of motors and generators comprises power motors up to and including 20 H.P. for direct current; up to and including ¼ H.P. for A.C. and polyphase motors up to 1 H.P., also low volt and standard volt generators up to 15 K.W. Write for Bulletins.

THE ROBBINS & MYERS CO., Springfield, Ohio

BRANCHES:—New York Chicago Boston Philadelphia St. Louis Rochester

Agencies in All Principal Cities

The "Standard" line of D.C. and A.C. Fans includes every phase of desk, bracket, oscillating, ceiling, exhaust and ventilating requirements. Ask for booklets.

"THIS BULLETIN 107-A is its own advertisement and is free on your request. You will be a better posted electrical man if you get it and read it."

BURKE ELECTRIC COMPANY Principal Office & Works ERIE, PA. 3

Essentials of a Perfect Motor:

Constant speed over wide range; absence of sparking; simple control and wiring; reversibility; lightness and compactness. These and many more

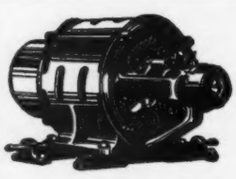
are all in

Inter-Pole Motors

They will not spark up to 100 per cent. overload. One handle, within easy reach, controls all speeds, forward and reverse. Ideal for shop service. Write for Bulletin.

ELECTRO DYNAMIC CO., Bayonne, N. J.

Arcade Bldg., Philadelphia, Pa. 200 Ninth St., Pittsburg People's Gas Bldg., Chicago



Every Demand for High Efficiency is met by Richmond Polyphase Motors

Their use is a positive guaranteed of economical operation—and their record is "satisfaction in every installation." Write for Bulletin No. 14.

Richmond Electric Works
Richmond, Virginia 3

BUY EMERSON FANS

at more favorable prices and conditions than before. Sell them at higher prices with the Emerson 5-year guarantee. Catalog, prices and contracts sent to dealers on request.

The Emerson Electric Mfg. Co.

50 Church St.
New York City.

2032 Washington Ave.
St. Louis, Mo.

It's Waiting for Dealers and Contractors

There is a great big profitable business waiting for dealers and contractors. It's the sale of Isolated Electric Lighting Plants in districts where Central Station current is not available. There are thousands of farmers scattered over the country to whom electric lighting plants can be easily sold. The farmers of this country are prosperous and are anxious to add to the comforts and conveniences of country life.

Electrical dealers and contractors will find this business easy to procure and very attractive, since profits are to be made on the sale of a gas engine, dynamo, switchboard and battery as well as from contracts for installing wiring and fixtures.

We have catalogues giving complete information on these plants which should be in the hands of every dealer and contractor. Copies can be secured from the nearest Sales Office. Write us to-day. Let us send you our catalogues and give you any information that you wish in helping you to start this business.

THE ELECTRIC STORAGE BATTERY CO.

New York Boston Chicago **PHILADELPHIA, PA.** Denver San Francisco Seattle
St. Louis Cleveland Atlanta Detroit **1888-1913** Los Angeles Portland, Toronto

USL TRADE MARK
THE UNITED STATES LIGHT AND HEATING CO.

Storage Batteries

High capacity, uniformity, long life and sustained voltage dependability.

The U. S. Light & Heating Co.
GENERAL OFFICES: 30 Church St., New York
FACTORY: Niagara Falls, N. Y.

Branch Offices and Service Stations
New York, Boston, Buffalo, Cleveland, Detroit, Chicago, St. Louis, San Francisco.

The Edison Storage Battery

"Built Like a Watch and as Rugged as a Battleship"

Edison Storage Battery Company
145 Lakeside Avenue
Orange, N. J.

FRICTION OR OIL— WHICH COSTS MOST?

Poor Oil Is Expensive. Good Equipment Deserves

"Anti-Corrosive Cylinder Oil"

We will prove to you, by sending enough for a 60 day test, that "A.C.C." is the best and cheapest although not the lowest in FIRST COST.

If it fails to "show you" we will accept *your* basis of value in settlement.

"Heads you win, Tails we lose."

Send for one or more barrels to-day.

ANTI-CORROSIVE CYLINDER OIL — MANUFACTURED ONLY BY E. H. KELLOGG & CO.

E. H. KELLOGG & CO.
243-244 South St. NEW YORK
Established FIFTY-THREE years ago. 3

Where long service is a consideration you will find the "1900" battery used

The NUNGESSER CARBON & BATTERY CO., Cleveland, O.

GOULD STORAGE BATTERIES

For central station service, propelling street cars, electric vehicles, low voltage lighting systems, etc. WRITE FOR LITERATURE.

Gould Storage Battery Co.

MAIN OFFICES:—241-7 Fifth Avenue, New York Works:—Depew, N. Y.
BRANCH OFFICES:—San Francisco, Chicago, Boston, Cleveland
AGENTS:—Detroit, Topeka, Los Angeles, Seattle.

Send us your next inquiry for brushes

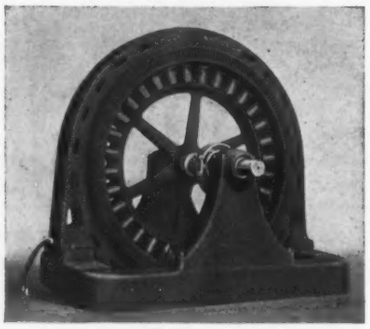
CORLISS CARBON COMPANY
BRADFORD, PA.
Branch Offices: New York Chicago Cincinnati

WILLARD STORAGE BATTERIES

FOR ALL PURPOSES
Manufactured by
The Willard Storage Battery Co.
Cleveland, Ohio

Crocker-Wheeler Generators

A. C.



D. C.

Coupled Type A.C. Generator.

These generators, A. C. and D. C. have many years of satisfactory service to their credit. They deliver the goods year in and year out, day in and day out.

One installation of eight D. C. generators is still giving perfect satisfaction after fifteen years of almost day and night service.

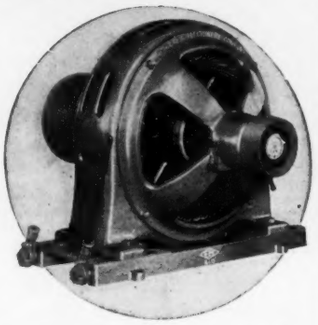
If you are interested in generators of this quality, write for one of our illustrated bulletins. Please state character of service required and current available.

Crocker-Wheeler Co., Ampere, N. J.
Offices in all Principal Cities

ELECTRIC MACHINERY CO

MINNEAPOLIS E M MINNESOTA

For the Small Plant Too



we have alternators which give just as dependable service as our big machines delivering thousands of Kilowatts.
The type shown here is built in sizes from 10 K. W. up to 200 K. W., and is belt-driven for power and lighting service in small Central Stations and industrial plants.
Tell us details regarding service and capacity required, and we will quote on a size and type of machine that will save money for you.

Ask for Bulletins Describing Our Entire Line

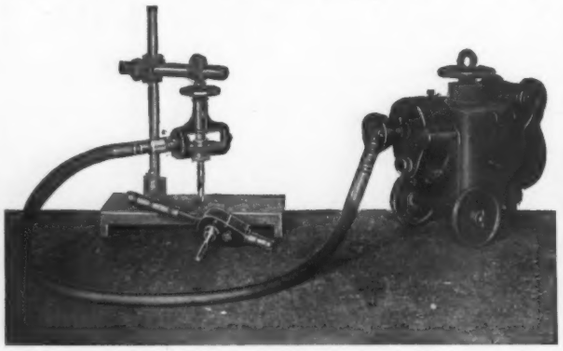
Is Your Material HEAVY? This Portable Drill Is LIGHT

Take the tool to the work
instead of taking the work to the tool.
It's a perfected combination of Stow Flexible Shaft and Inclosed Multi-Speed Motor, which gives

The Exact Speed Required

for any drilling, tapping or reaming operation within the capacity of the tool.
Rheostat and starting box are eliminated—an absolutely unbroken range of speeds is secured by a turn of the hand wheel.
A reel with 60 feet of insulated wire enables you to work at a distance from the nearest source of power.
This outfit is fully described on p. 47 of our Catalog No. 13—write for your copy.

Stow Manufacturing Co.
Binghamton, N. Y.
Selson Engineering Co., 85 Queen Victoria St., London, Eng.



Special Motors for Special Purposes

Have you any unusual drives that need special motors? We can help you out. We have exceptional facilities for getting out special design without delay. C & C Motors are made to order.

Send us your specifications

C & C Electric & Mfg. Co.
Main Office and Works:
Garwood, N. J.

5-B

SPLITDORF

SPLITDORF "TS" COILS, MAGNETOS and SPARK PLUGS form a trinity of ignition perfection that every owner of a gasoline motor should know about.
Write TO-DAY for new catalogue

SPLITDORF ELECTRICAL CO.
98 Warren Street, Newark, N. J.

RELIANCE ADJUSTABLE SPEED MOTOR

This motor gives unlimited running speeds over any range up to 1 to 10
No electrical controller used.

Reliance Electric & Engineering Co.
1046 Ivanhoe Road, Cleveland, Ohio

KIMBLE MOTORS

Sell More Power to Printers

Every gas, gasoline or other engine running cylinder presses in your vicinity represents just so much power which you ought to be furnishing—and which you would be furnishing if you had explained to that printer why

The New Single Phase Variable Speed Alternating Current

KIMBLE CYLINDER PRESS MOTOR

With Auto-Transformer Controller

is cheaper in its ultimate economy than any other form of power.

Instead of consuming top-speed current at every speed, no matter how slow, as all ordinary motors do, this motor reduces operating cost in proportion to every reduction in speed. In other words, *operating cost is proportional to press speed*—a feature found in no other motor.

Average press speed is about 60% of the maximum. It will thus be seen that the average saving of a Kimble Motor is 40% of the power bill.

The unique auto-transformer Controller starts a cylinder press calling for full torque, on 29% of full load wattage and 60% of full load current, on 60 cycle circuit.

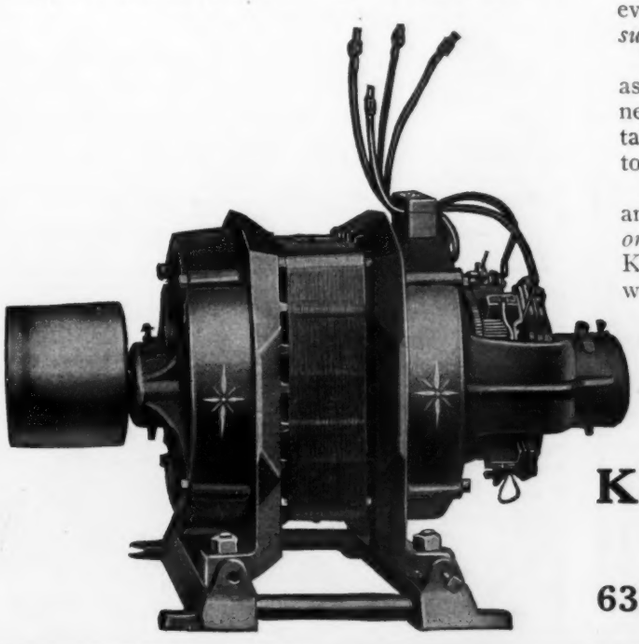
Compare this with slip-ring induction motors. On 60 cycles, the induction motor takes 1.7 times as much current and 3.5 times as much wattage as the Kimble. On a 25-cycle circuit the induction motor takes 3.5 times the current and 4.3 the wattage recorded for the Kimble.

Speed range on the new motor includes 18 forward and 18 reverse speeds. Smooth press operation can be secured, if desired, at as low as *one-fourth* maximum speed.

These points—and others scarcely less in importance—will be instantly appreciated by every *practical* printer—which means every *successful* printer.

You will do as fine a bit of education work as you have ever done, if you send for our new Red Catalog, assimilate the facts contained therein, and pass the good news along to the printers in your vicinity.

For Example—In one printers' building in an Eastern city the splendid performance of *one* Kimble Motor led to the sale of 62 Kimble Printing Press Motors within a few weeks' time.



Send for the Red Catalog

Kimble Electric Company

637 North Western Ave., Chicago

ALLIS-CHALMERS
Self-Cooled Transformers have this distinctive feature

The transformer tank, made of heavy boiler plate, is surrounded by one or more jackets connected to it at both top and bottom by tubular openings which permit a constant circulation of oil.

The joints of both the tank and jacket are thoroughly welded making them absolutely oil tight and giving a very strong mechanical construction.

The annular spaces between the tank and jackets serve as flues, providing a large and rapid circulation of air, which readily diffuses the heat losses.

With this construction self-cooled transformers can be built in large sizes and low operating temperatures are assured.

ALLIS-CHALMERS MANUFACTURING CO.
Milwaukee, Wis.
Offices in All Principal Cities

For Canadian Business Refer to Canadian Allis-Chalmers, Limited, Toronto, Ont., Canada.

FOREIGN REPRESENTATIVES:
Frank R. Perrot, 883 Hay St., Perth, W. Australia.
Frank R. Perrot, 204 Clarence St., Sydney, N. S. W.
H. I. Keen, 732 Salisbury House, London Wall, E. C., London, England.
Mark R. Lamb, 87 Galeria Beeche, Casilla 2653, Santiago, Chile.

Cutting Costs Does Not Cut Commutators

Just so long as you let our Brush Engineers recommend a brush for your machines, you can be sure that your operating expenses will decrease and your commutation improve in every way.

Try It

NATIONAL CARBON CO.
CLEVELAND, OHIO

ROTHMOTORS

Are sold under a guarantee that reflects our confidence in their performance — a confidence that is justified by the satisfaction they have given under the most severe conditions.

BLOWERS
GRINDERS
POLISHERS

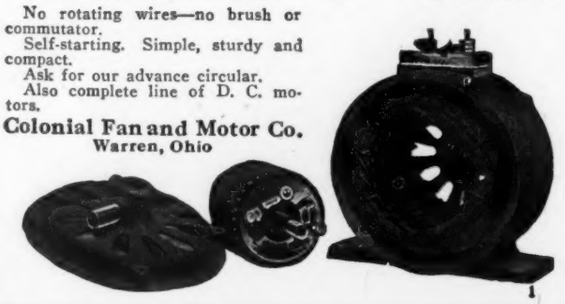
Philadelphia, Herd Bldg.
Pittsburgh, 1415 Keenan Bldg.
Cincinnati, 126 W. 2d St.
San Francisco, Monadnock Bldg.

ROTH BROS. & CO.
1400 W. Adams St.
CHICAGO

No Clutch Is Necessary
either in the motor or outside, when you *use*
Colonial A. C. Motors

No rotating wires—no brush or commutator.
Self-starting. Simple, sturdy and compact.
Ask for our advance circular.
Also complete line of D. C. motors.

Colonial Fan and Motor Co.
Warren, Ohio



Wagner Quality

NOTABLE NEW APPARATUS
Built by Wagner Electric

THE NEW WAGNER

UNITY-POWER-FACTOR MOTOR

Corrects the power factor on the customer's premises.

Bulletin 94.

SINGLE-PHASE CONVERTER

Changes A.C. to D.C. for charging vehicle batteries for moving picture machines, etc. No tubes to renew. Operates as a motor also.

Bulletin 97.

SMALL PORTABLE RECTIFIER

Changes Commercial A.C. to D.C. for charging small storage batteries. Makes possible Electric Auto Lighting from Central Station Supply.

Bulletin 93.

Are you conversant with these new developments? Are you securing the advantage, the solving of your problems, the increased revenue—they make possible? Does the Company who is not content to merely manufacture—to follow, to copy—but who originates and whose originations make good, commend itself to your co-operation and support?

Send for Wagner Bulletins.

2204

Wagner Electric Manufacturing Company, Saint Louis

Forget First Cost

and fix your eye on operating cost, when buying brushes. Even though the first cost of

"Le Carbone" Brushes

is greater than that of other carbon brushes, the experience of hundreds of Central Stations proves them to be far more economical in the long run.

W. J. JEANDRON, 174 Fulton Street, New York

1

When Reactance Voltage Is High

and other influences prevent good commutation, use

MORGANITE BRUSHES

and stop the trouble. They have low contact-resistance on the edge where current enters, and high contact-resistance on the edge where it leaves, thus facilitating sparkless collection of current.

If you have brush troubles, send us data on your machine, and we will send you sample Morganite Brushes.

THE MORGAN CRUCIBLE CO., LTD.
114 Liberty Street, New York City

LEWIS-ROTH CO., Denckla Bldg., Philadelphia, Pa.
INDIANAPOLIS BRASS CO., Indianapolis, Ind 1

High-Grade Carbon Brushes

The heads of a thousand dynamo rooms state positively over official signatures that LE VALLEY VITAE CARBON BRUSHES

Actually save their first cost again and again;
Save time, labor and annoyance;
Save commutators, keeping them unscratched and glossy;
Save shut-down losses and repair bills;
Save and make reputations for men and machinery;

Are in fact the one absolutely proven, generally admitted high-grade Carbon Brush, worthy of complete dependence and exclusive use in all places under all circumstances.

Le Valley Vitae Carbon Brush Co.
4123 Park Ave., New York City
Catalogs and Testimonials on Application

Abolish Smutty Commutators

They may or may not be due to poor brushes. They may be caused by improperly adjusted tension springs in the brush holder or the use of lubricants. But

Speer Carbon Brushes

will not smut commutators if the tension springs are properly adjusted. They contain no calcined lampblack. It's the presence of this inferior base material that makes some brushes smut and thus injure both brush and commutator. Further—Speer brushes are self-lubricating.

Brushes for every service in the Speer line. Samples await you—also descriptive printed matter.

Speer Carbon Co.
St. Marys, Pa.

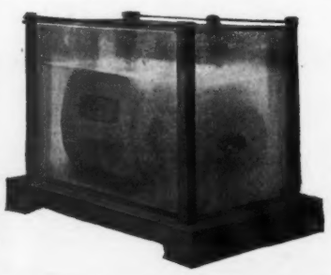
DIXON'S SOLID Belt Dressing

Has the unique quality of preventing belt slippage without causing that stickiness which consumes power in doing useless work. It is easily applied, acts instantly, and is equally effective on leather, rubber, canvas or fabric belting. Write for the booklet, "Proper Care of Belts," No. 47.

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY Established 1827 **NEW JERSEY**

Lincoln Motors

impregnated with our special oil and waterproof varnish.



Operate Under Water

All windings both direct and alternating current are insulated in the same way.

LINCOLN ELECTRIC COMPANY
Kelley Ave. & 38th St. Cleveland, O.
918 Monadnock Bldg. Chicago, Ill.

HAVE YOU EVER STOPPED TO CONSIDER

SOME BELT DRIVES are more efficient and wear better than others.

THE PULLEY on which the belt takes best "grip" is the pulley for lowest slip and maximum belt wear.

HIGH BELT SLIP is a direct loss of power. Furthermore it generates heat which dries out the belt, robbing it of strength and vitality. Such belts wear poorly.

THERE IS ONE KIND OF PULLEY THAT INSURES LOWEST SLIP AND MAXIMUM BELT WEAR.

THE ROCKWOOD PAPER PULLEY

"A PERFECT PULLEY FOR BELT DRIVES"

ITS SUPERIORITY over other kinds of pulleys is real and the difference is worth while.

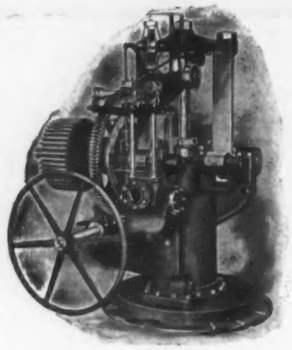
BACK OF EVERY ROCKWOOD PAPER PULLEY is over twenty-five years of continued satisfactory service.

TO-DAY it is the accepted standard for motor and generator belt drives.

THINK IT OVER—THEN WRITE—the proof is yours for the asking.

THE ROCKWOOD MANUFACTURING COMPANY

INDIANAPOLIS, INDIANA, U. S. A.



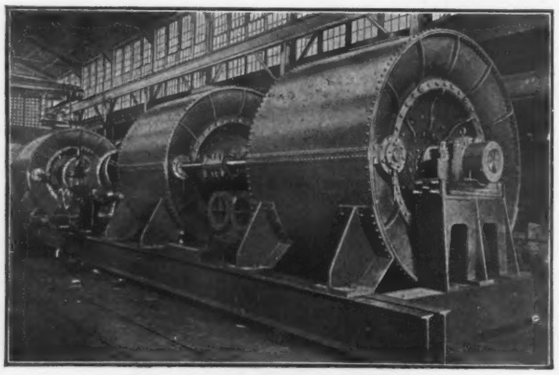
N. 14 Governor.
60,000 ft. lb. capacity.

FIRST OF ALL—RELIABILITY

The production of every one of our standard governors is the result of long continued, painstaking labor and conscientious care on the part of our employees. Our machines are governing many million horse-power of water wheels throughout the world.

Write us if you have difficult problems to solve.

THE LOMBARD GOVERNOR CO.
ASHLAND, MASS.

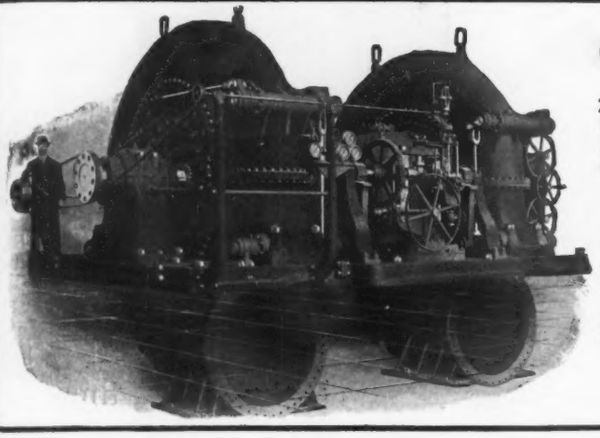


SAMSON HYDRAULIC TURBINES

16000 Horse Power

Four of these units installed for the Madison River Power Company, Montana, operating under 110 ft. head, direct connected to 2400 K.W. generators. Total capacity 16,000 H.P. We build any design and capacity of turbines required. All of our work fully guaranteed in every detail. Let us send you our new illustrated catalog.

JAMES LEFFEL & COMPANY
308 Lagonda Street, Springfield, Ohio



ONE OF SIX UNITS

7200 H.P. each, 225 R.P.M., 100 feet head. Built for the Great Falls Water Power and Townsite Co., Great Falls, Montana. These turbines when tested in place gave an efficiency of 88% at 7-10 and 8-10 gate opening.

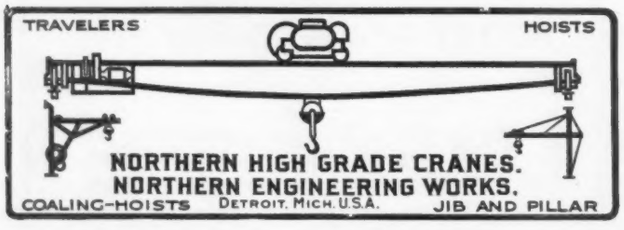
Francis Turbines of 145,000 H. P. now in daily use

Turbines designed to meet all requirements for heads from 3 ft. to 600 ft.

Write us if interested.

S. MORGAN SMITH CO., - York, Pa.

BRANCH OFFICES: 176 Federal St., Boston, Mass.
644 American Trust Bldg., Chicago, Ill.



TRUMP TURBINES

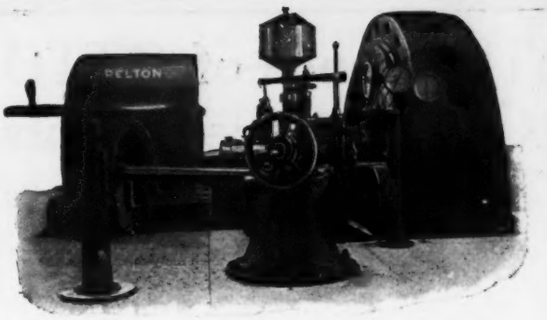
All styles and designs built to suit your location. Send at once for our illustrated catalog.

THE TRUMP MFG. COMPANY
Columbia & Greenmount Aves., Springfield, Ohio

TROLLEYS

MARIS BROS.,
PHILADELPHIA

Special
Blanking, Trimming, Piercing & Forming
DIE WORK
Solicited
The Columbus Die, Tool & Machine Company
Columbus, Ohio



The Overhung Type of

PELTON WHEEL

offers many conveniences to the construction engineer; and meets the most difficult operating conditions.

Wheel runner and generator rotor are rigidly connected, can be handled as a unit, and reduce alignment difficulties to a minimum.

Bearing construction is simplified, floor space per K. W. reduced to a minimum and foundation work reduced to one monolith.

It will pay you to investigate Pelton overhung wheels.

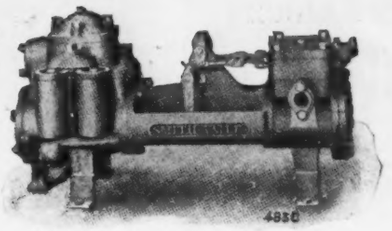
4

PELTON WATER WHEEL COMPANY

2231 Harrison Street, San Francisco, Cal.

91 West Street, New York, N. Y.

PLATT



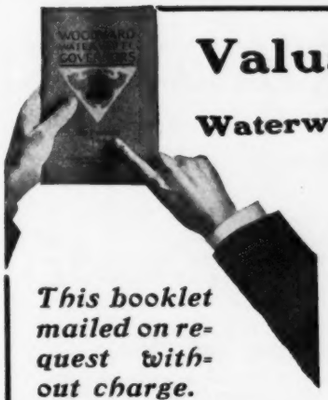
"SMITH-VAILE" BOILER FEED PUMP YOKE TYPE BOX

Rugged — Durable — Accessible. The suction valves are located in separate chambers and are reached by removing one nut.

Water cylinder liners cast separate; removable and interchangeable.

P-13

THE
PLATT IRON WORKS
COMPANY
DAYTON, OHIO
PUMPS FOR EVERY SERVICE



Valuable Data
ON
Waterwheel Governor Construction

is contained in this booklet, a copy of which will be sent postpaid to any address on request.

This booklet mailed on request without charge.

Woodward Governor Co.
202 Mill St., Rockford, Ill.

VALVE and FITTINGS
All Sizes for all Purposes
Complete Piping Systems

PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION CO.
PITTSBURGH, PA.

WATER WHEEL GOVERNORS

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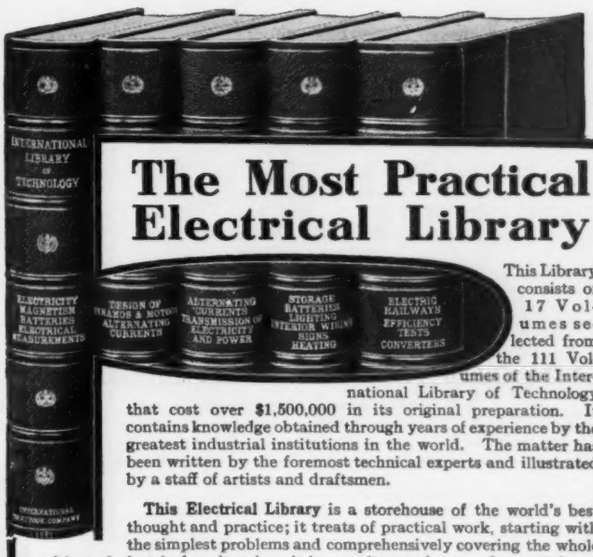
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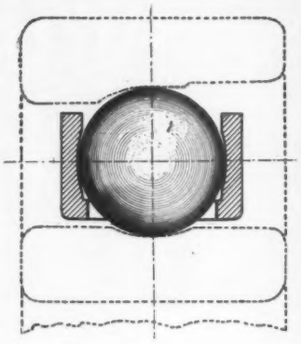
Norma Silent-Running Ball Bearings



The Norma ball cage is a light ring of elastic metal holding the balls at their polar surfaces only, where the rotative speed is lowest. There can be no play to the balls; they cannot touch one another; they cannot be displaced. A slight elastic pressure on the balls prevents all chattering or noise. And the extreme precision gives only the freedom necessary to minimize friction.

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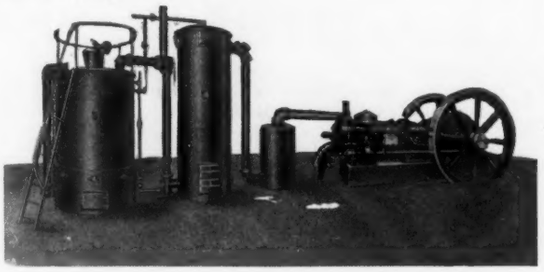
22-26 Vesey St. New York

Thousands of OTTO Gas Producer Plants Pay Big Dividends

and are being satisfactorily operated by men of ordinary intelligence.

The small space required, extremely low fuel-cost, and very moderate charge for attendance, should make an Otto Plant your choice for any service requiring from 13 to 250 H. P.

Bulletin No. 24 goes thoroughly into the details of design and construction, and is yours for the asking.



The Otto Gas Engine Works 3207 Walnut Street Philadelphia, Pa.

1

HIGH VACUUM APPARATUS

C. H. Wheeler High Transmission Surface-Counter Current Barometric and Low Level Jet Condensers
Reciprocating, Rotary and Hydraulic Entrainment Vacuum Pumps
Centrifugal Pumps Cooling Towers
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"Everything But the Turbine"

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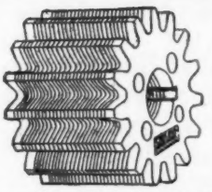
Philadelphia, Pennsylvania

BRANCHES—New York, Boston, Chicago, Cleveland, Pittsburg, Charlotte, N. C.; San Francisco.



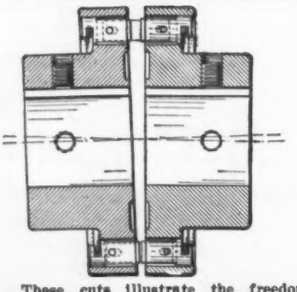
A rawhide pinion costs more than a metal pinion, but—

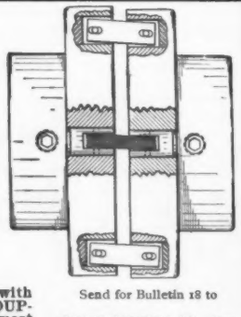
it is worth three or four of them when length of life is considered and it is tremendously more valuable when you consider that the rawhide pinion takes all the wear, thus prolonging the life of the metal gear, which is far more expensive.

Chicago Rawhide Gears and Pinions

in addition to effecting maintenance economies, eliminate noise, reduce friction and vibration and increase efficiency generally. Write for Booklet G.

THE CHICAGO RAWHIDE MFG. CO.
1303 Elston Ave., Chicago.





These cuts illustrate the freedom with which the FRANCKE FLEXIBLE COUPLING takes care of misalignments, almost always present with direct coupled shafts. The FRANCKE is a proven success, a radical departure from all past attempts at a flexible coupling, as it is all metal, with no rubber, leather or fiber parts. New bulletin gives a full and interesting description of how to eliminate your alignment troubles.

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SMITH-SERRELL CO., Inc.

General Sales Agent for

THE FRANCKE CO.

90 West St, New York

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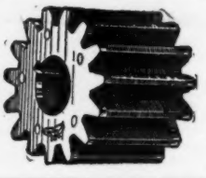
FOR MOTORS REDUCE THE COST OF UP-KEEP

THE HESS-BRIGHT MANUFACTURING COMPANY

37 East Erie Ave. Philadelphia, Pa.

Noiseless Pinions



for motor and other high speed drives
See our large advertisement in first and third issues of the month.

New Process Gear Corporation

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Span the gap between your motor and your customer's machine with

MORSE Silent Chains

YOUR motor, the transmission system, and the machine to be driven are equally important links in an imaginary chain.

You spend months, yes, years, developing different types of motors.

You investigate the service which the machine is to perform, then select the type of motor best suited for such service.

You know what your motor **should** do, and what the machine **should** do. But, will they do it? Much depends upon the transmission system.

By using MORSE Silent Chain Drives you insure two things:

(1) **Elimination of power losses in transmission.**

(2) **Smooth, uninterrupted motor operation.**

Your customer demands such apparatus as will insure full-capacity machine operation at all times.

You owe it to yourself to use that transmission which means longer life to your motors, and lower maintenance cost.

MORSE Silent Chains afford a flexible, positive, silent drive of practically 99% maintained efficiency.

Why couldn't we get together for our mutual benefit? Write our Engineering Department for particulars and copies of Chain and Sprocket Data Sheets, and Bulletin No. 11 descriptive of the chain and its application.

Morse Chain Company, Ithaca, N. Y.

A-89

It Costs Less

to make ice by using your exhaust steam in a

Carbondale Ice Machine

than to operate your plant condensing. Dozens of progressive Central Stations all over the country have found that ice making pays the entire cost of operation, leaving income from current clear profit.

In any case, you'll find that our plan will greatly reduce your cost of generating current.

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to help your present equipment carry your peak load, when a

Remington Oil Engine

will give you the required extra capacity at a mere fraction of the investment?

Running on cheap fuel, such as kerosene, fuel oil, gas oil or distillate, it requires least possible operating and attendance cost. Although comparatively light, regulation is extremely close.

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SAVE YOUR HEAT ENERGY

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A Tin Lined Wood Casing for Insulating Underground Steam Pipes which is composed of the Most Efficient Non-Conductive Materials Known.

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WHAT IS YOUR POWER NEED?

If it's anything between 1/32 H. P. and 20 H. P., we can supply it perfectly with an

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We can guarantee you particularly high efficiency in small sizes—something not every motor builder can do.

Write today for Bulletin.

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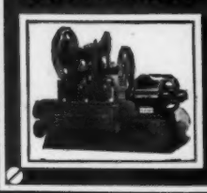
FOR OPERATION BY ELECTRIC MOTOR, GAS OR GASOLINE ENGINE, OR BELT DRIVEN FROM LINE SHAFT. CONTINUOUS FLOW FROM DISCHARGE.



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HARRIS PUMP & SUPPLY CO. Pittsburg
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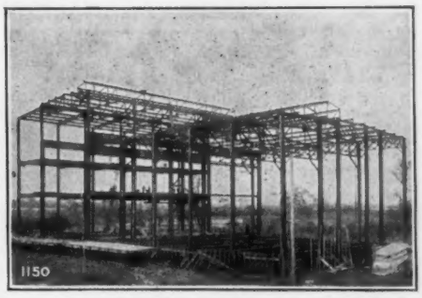
Manufacturers of Steel Structures of all classes particularly **BRIDGES AND BUILDINGS**



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PITTSBURGH, PA. . . . Frick Building
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St. Louis, Mo., Third Nat'l Bank Building
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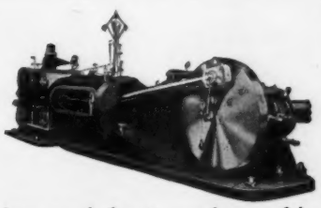
MURRAY CORLISS ENGINES



Engine on exhibition in the Bourse Philadelphia,

are of the latest design and best workmanship and excel in regulation, effiiciency and economy.

MURRAY BOILERS

whether water-tube, tubular or marine, are always of the highest grade.

MURRAY IRON WORKS CO. Burlington, Iowa

Incorporated, Feb. 1st, 1870.

An Even Steady Fire

is always maintained in the

RILEY

Self-Dumping Underfeed

STOKER

by uniform air supply at low pressure.

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SANFORD RILEY STOKER CO., LTD.
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51-7

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For Water Tube and Tubular Boilers

GREEN ENGINEERING CO.

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Catalogue "G"—Green Chain Grate Stoker.
Catalogue No. 8—GECO Pneumatic Ash Handling Systems sent on application.

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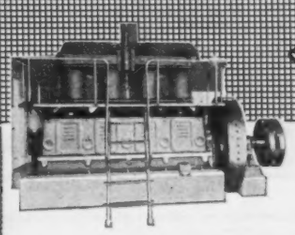
BEING 60 PER CENT. PURE GRAPHITE INSURES LOW RESISTANCE, NO SPARKING UNDER VARYING LOAD, LONGER WEAR AND NO GREASING.

HOLMES FIBRE-GRAPHITE MFG. CO.
GERMANTOWN, PHILADELPHIA, PA.

Bruce-Macbeth Gas Engines



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A Gas Engine of Proven Worth

For electric lighting, pumping and all general power purposes, using natural, artificial or producer gas.

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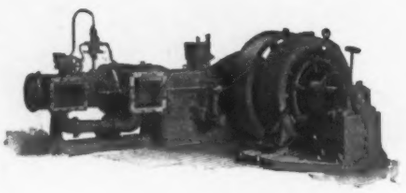
For Combined Light and Elevator Loads Specify Ball Engines



BECAUSE this service demands substantial construction and good regulation.

Here are a few BALL installations that will be of interest to you:

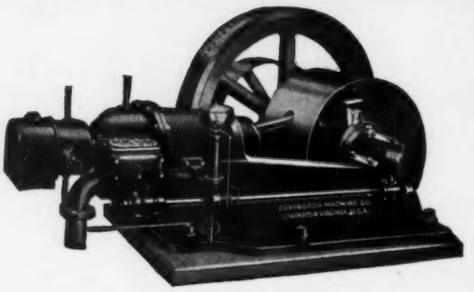
Blackstone Hotel, Chicago; Dime Savings Bank, Detroit; Morris Building, Philadelphia; Filene Building, Boston.

Investigate and inspect BALL engines. Catalogue on request.

Ball Engine Co.

ERIE PENNA.

2



Reduce the Overhead Charges

on your product by reducing your power expenses—do it by installing

COVINGTON OIL ENGINES

ASK YOUR CONSULTING ENGINEER

Fuel-Saving—With fuel oil at 3 cents per gallon, the cost for each 100 H.P. hours will not exceed 39 cents with Type A, and 32 cents with Type B.

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Compare the above with your present expense of operating a producer-gas or steam plant—and remember that Covington Oil Engines involve no operating expense whatever, except when actually running—stand-by losses are eliminated.

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reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All of this may be avoided if you use

The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

It will put that high gloss on the commutator you have so long sought after

Send for Stick **50c PER STICK** **$5.00 PER DOZ.**

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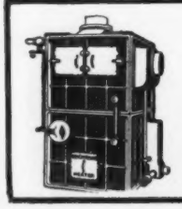

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Feed Water Heaters and Purifiers
Feed Water Heaters and Receivers
Steam and Oil Separators
Sorge-Cochrane Hot Process System of Water Softening
Multiport Safety Exhaust Outlet Valves for Back Pressure and for Vacuum Service

Harrison Safety Boiler Works
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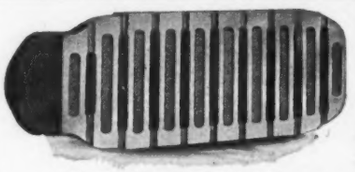

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This Valve

Used on our Type "F" Four Valve Engines

Stays Tight

and insures

Maintained Economy

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AUBURN, N. Y., U. S. A.

WE ARE RECOGNIZED EFFICIENCY ENGINEERS

on all problems arising from the use of unsatisfactory boiler water supplies. We offer you the benefit of a quarter century's practical experience in the scientific treatment of boiler feed waters. Thousands of power plant operators in this country and all over the world have benefited from this service. We are at your service in solving your boiler water problems.

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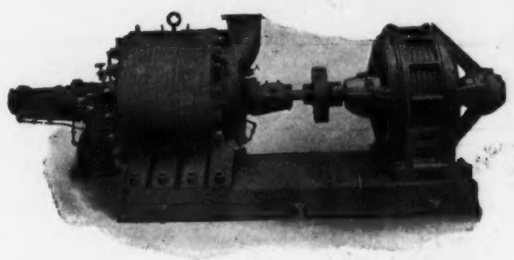
WORTHINGTON TURBINE PUMPS
For High Head Service



Turbine Centrifugal Pumps

with Electric Motor or Steam Turbine drive, on account of their high speed, are extremely **Efficient.** Further, they are **Compact,** practically **Noiseless in Operation,** exceptionally **Reliable,** and require very **Little Attention,** especially commending them for **Elevator, House, Tank, Fire, and Boiler Feed Service.**

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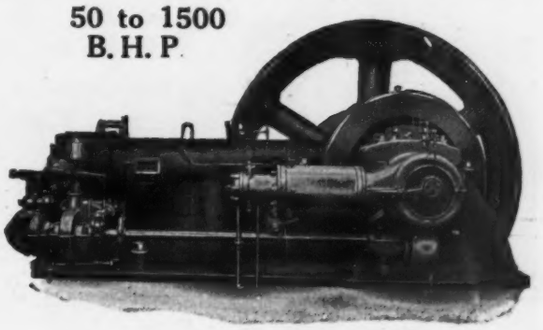
Henry R. Worthington
115 Broadway, New York

Works: Harrison, N. J. **Offices in All Large Cities**

W190.2

The Snow Oil Engine
will reduce your power bill

50 to 1500 B. H. P.



These Snow Engines will operate on the **Cheapest of Oils** with the Lowest Fuel Consumption of any known type of Prime Mover. **Their service is reliable.**

A special feature being the type of combustion which causes the engine to run evenly and quietly, the exhaust being free from odor and invisible. It is particularly adapted to close regulation, consumes no fuel when not in operation and is available for instant use. Controlled by a single lever, the Snow Oil Engine is the most economical and practical internal combustion engine on the market.

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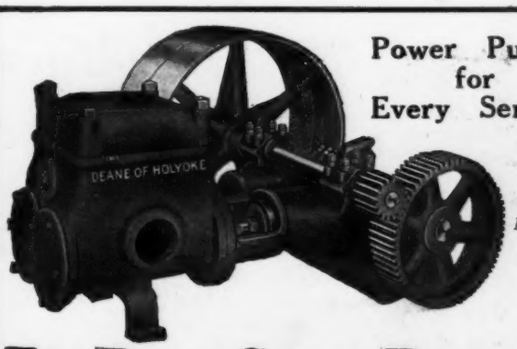
Snow Steam Pump Works

Works: **Buffalo, N. Y.**

New York Office: **115 Broadway, N. Y.**

Branch Offices in all Principal Cities S120.2



Power Pumps for Every Service

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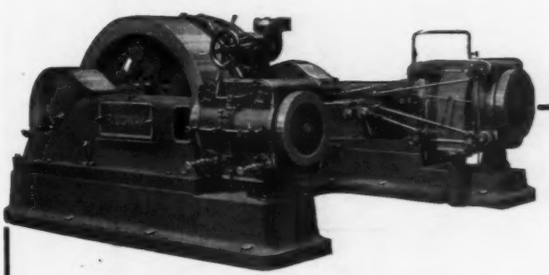
THE DEANE STEAM PUMP CO.

115 Broadway, New York **Works: Holyoke, Mass.**

Branch Offices in all Principal Cities. D224.1



Sparkless

commutation from O to the sharpest and heaviest overload—that's what the balancing coils built into the pole pieces accomplish for

Ridgway Units

Not only that, but they also reduce commutator temperature and augment overload capacity to a great degree.

Ridgway Units respond instantly to quick changes of load; and the momentary variation of speed under the heaviest overload is rarely more than 2%.

There is much more that you should know about them in our Bulletins, which are yours for asking.

Ridgway Dynamo & Engine Co.
Ridgway, Pa.

BLAKE-KNOWLES

OPEN FEED-WATER HEATERS INCREASE BOILER EFFICIENCY

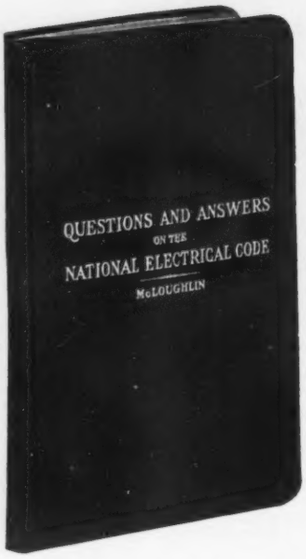
WRITE FOR BULLETIN BK 847—38.

The Blake & Knowles Steam Pump Works

115 Broadway, New York. Works: E. Cambridge, Mass.

Branch Offices in All Large Cities B207.1

For Contractors



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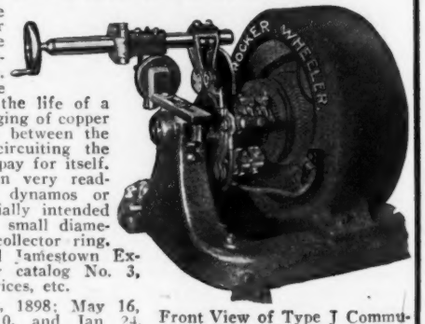
Patented April 26, 1898; May 16, 1905; Sept. 6, 1910, and Jan 24, 1911. Other patents pending.



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KVA.		Speeds
1	10	Gen. Elec., type AS, single-phase, rev. arm., 80 amp., 125 volt 1800
1	37½	Ft. Wayne, type WAL, single phase, rev. armature, comp., 2200 volts.. 900
1	72	Electric Machinery Co., rev. field, 3-phase, 2300 v..... 720
1	75	Ft. Wayne, type WAL, single-phase, revolving armature, comp., 2200 volts. 600
1	100	Ft. Wayne, type WAL, single-phase, rev. armature, comp., 1150 or 2300 v. 900
1	100	National, 3-phase, rev. field, 440 volts 900
1	100	Gen. Elec., type ATB, form P, 3-phase, rev. field, 220 or 440 volts, with belted exciter 900
2	120	Gen. Elec., type AS, single-phase, rev. arm., comp., 2300 v. 900
1	120	Westinghouse, two-phase, rev. armature, comp., 1100 volts 720
2	180	Gen. Elec., single-phase, type AS, rev. armature, comp., 1100 or 2200 volts 600
1	200	Western Elec., type S20EO, revolving field, 440 volt, 3-phase 600

250-Volt D. C. Compound Generators

KW.		Speed
1	17½	Commercial, direct-connected "Merriam" - Bruce - Macbeth 2 cyl. vertical gasoline engine... 300
2	20	Allis-Chalmers ...1150
1	20	Allis-Chalmers ... 900
1	22½	Crocker-Wheeler .. 880
1	25	Gen. Elec., MP..1100
1	25	Allis-Chalmers ... 750
1	30	Browning 1100
1	30	Elec. Mach. Co... 950
1	30	Northern 900
1	30	Crocker-Wheeler .. 850
1	30	Allis-Chalmers ...1300
2	30	Commercial 600
1	30	Ideal, MP 600
4	30	Sprague 900
1	33½	Jenney 1175
1	40	Northern 650
1	45	Western Elec. ... 550
1	65	Allis-Chalmers ... 900
1	100	Jeffrey 480
1	125	Allis-Chalmers ... 525
1	150	Westinghouse, MP, 3-wire, 125 - 250 volt, with balance-coils, complete.... 580

550-Volt D. C. Comp. Generators

KW.		Speed
1	73	Westinghouse, MP, type S, comp..... 925
1	85	Gen. Elec. MP, form H, comp.... 750
1	150	Gen. Elec., 6-pole, form A, comp.... 400
2	200	Westinghouse, 6-pole, comp. 510
1	250	Westinghouse, 6-pole, comp., 3-bearing (pulley 37x42 in.) 450

125-Volt D. C. Generators

Lights		Speed
2	100	Westinghouse 1400
1	110	Allis-Chalmers ...1800
1	110	Sprague-Lundell ..1300
2	150	Ft. Wayne 1000
1	150	Western Elec..... 625
1	160	Westinghouse. ... 950
1	180	Fairbanks-Morse .1350
1	180	Ideal 1000
1	200	Willey 1200
1	210	Gen. Elec. 1200
1	210	Crocker-Wheeler... 960
1	220	Fairbanks-Morse. 1250
1	270	Commercial 1000
1	270	Northern, 15 KW. 700
1	300	Triumph, 17½ KW.1200
1	300	Westinghouse 1125
1	300	Triumph 800
1	350	Commercial 1280
1	400	Crocker-Wheeler ..1150
1	400	Westinghouse 975
1	400	Westinghouse 700
1	450	Browning 1050
1	450	Sprague-Lundell .. 850
1	450	Westinghouse 600
1	450	Westinghouse, 6-pole, 25 KW., direct connected to Westinghouse, Jr., vertical auto. engine 350
2	450	Gen. Elec., type C, form T, direct-connected to Curtis form A non-condensing turbine, 100 lbs. pressure, 25 KW.....3600
2	450	Gen. Elec., 25 KW. direct-connected to 3-cylinder Westinghouse vertical gasoline engines..... 350
1	540	Sprague 800
1	540	Western Elec..... 650

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2—400	Ft.	Wayne	250	..	100	Allis	Heavy Duty Cross Comp. Cor.
2—400	Westge.		250	10	150	18&36x30	Porter Allen Hor. Tand. C.
300	Gen.	Elec.	250	6	130	20&34x34	Ball & Wood Vert. Cross C.
200	Westge.		250	8	100	15&26x36	Fulton Cor. H. Duty T.C.H.
3—200	Gen.	Elec.	125	8	200	15&26x17	Macl. & S. Hor. Tand. Comp.
160	Gen.	Elec.	250	8	230	17½x18	Buckeye Heavy Duty
125	West.	Elec.	220	6	220	16x18	Erie Ball 4 Valve Hor.
100	Westge.		250	8	225	16&24x18	Ideal Tand. C.
100	Triumph		250	8	250	Ideal	Tand. Comp. Hor.
2— 75	Gen.Elec.		125/250	..	2400	Curtiss	Hor. Steam Turbine
2— 75	Bullock		250	6	275	Vert.	3 Cylinder Gas Engines
2— 50	Gen.	Elec.	250	6	276	12x12	Skinner Auto. Engines
2— 50	Triumph		125	6	..	12x12	Russell Auto. Engines
35	Triumph		250	6	300	11x10	Chandler & Taylor
35	De	Laval	120	..	1500	De Laval	Hor. Steam Turbine
20	Triumph		125	6	340	8x9	Chuse Hor. Autom.

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K.W.	Make	Genr.	V.	Ph.	Sp.	Engine	Description
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800	Gen.	Elec.	2300	3	90	26&52x48	Geo. H. Corliss Hor. C. C.
800	Al.-Ch.		2200	3	3600	Al.-Ch.	Hor. Steam Turbine
560	Bullock		2300	3	150	16&30x27	Buckeye
500	Gen.	Elec.	2300	3	150	18&36x36	Macl. & Sey. Hor. Cross C.
450	Bullock		2300	3	150	19&36x30	Buckeye Hor. Cross Comp.
2— 400	Westge.		440	3	3600	Westge.	Parsons Steam Turbines
3— 300	Gen.	Elec.	600	3	164	American	Diesel Oil Engines
2— 300	Gen.	Elec.	2300	1	150	16&26x30	Macl. & Sey. Hor. Comp.
250	Westge.		2300	2	180	16&30x24	P. I. Wks. Hor. Cross C.
2— 250	Ft.	Wayne	2300	2	200	16x24	Ham. Hor. Corliss
200	Stanley		2300	2	..	Chuse	Auto. Hor. Simple
175	Westge.		2200	2 or 3	189	13&25x21	Buckeye Hor. T. Comp.
135	Westge.		440	3	240	16x18	Westge. Vert. 3 Cyl. Gas
100	Gen.	Elec.	2300	1	277	10&18x14	Ideal Tand. Comp.
75	Westge.		2200	3	277	13½x13	Chuse Slide Valve Auto.
75	Gen.	Elec.	2300	3	1250	De Laval	Hor. Steam Turbine
75	Westge.		2200	3	300	10&18x12	Reeves Vert. Comp.
2— 65	Westge.		2200	3	300	8½&15½x12	Reeves Vert. Comp.

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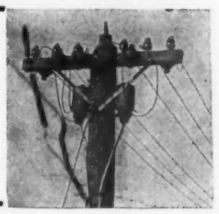

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1—50 K.W., 125 v., 280 R.P.M., G. E. generator to an Ames engine.
1—50 K.W., 125 v., Sprague gen. to a Watertown eng. 13 x 14.
1—60 K.W., 250 v., 3 wire, 200 R.P.M., type RBO, General Electric engine type generator only, new with transformer and switchboard.
1—75 K.W., General Electric Turbine set, 125 v., 2400 R.P.M.
1—75 K.W., 125 v., 6 pole General Electric direct connected to a Ballwood engine 14 x 12.
1—75 K.W., 125 v., Eddy generator to a Harrisburg engine 15 x 13.
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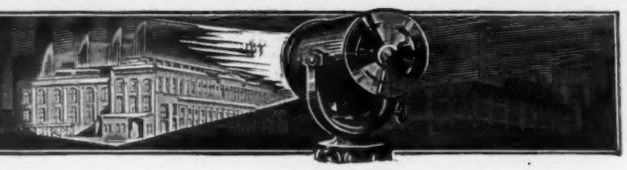
Section of the ELECTRICAL WORLD

Generator at Big Bargain.

In first-class condition for immediate delivery. 300 K.W. G. E. 6 pole, 500 volts, D.C. 400 R.P.M. Will sell for $1,000 f.o.b. cars New England. H. E. Salzberg & Co., 30 Church st., New York City.

SEARCHLIGHT SECTION



FOR SALE

Electric Light Plant for Sale

1—800 KVA, 80 per cent P. F. phase, 60 cycle, 2300 volt General Electric Revolving Field Generator direct connected to 20 x 42 x 30 in. vertical cross compound Great Lakes Engineering Works engine. Outfit brand new. Immediate shipment. Hoisting Machinery Company, 50 Church Street, New York.

Big Bargains

in motors and dynamos; over 2000 in stock in N. Y. All guaranteed; every size, ⅛ to 50-HP. We buy, sell, exchange any kind of electrical apparatus. Nathan Klein & Co., 236 Canal Street, New York City.

Electric Units for Sale

2—400 KW., 250 volts, 115 R.P.M. D. C. generators, 10 pole, vertically split frame type, each direct coupled to a 20 x 42 x 30-in. vertical cross compound engine. Outfits brand new. Immediate shipment. Box 503, Elec. World.

Generating Set for Sale

100 KW. direct connected set 16 in. x 14 in. Watertown engine direct connected to 100 KW. General Electric generator, 250 volts, 6 pole, speed 250 full commutator, nearly new. Joseph Myerson, 274-278 Commercial St., Boston, Mass.

For Sale Very Cheap to Quick Buyer

A pair of 35-in. Trump Horizontal Type Waterwheels with casing complete, together with large pulley, double leather belt and belt tightener. This equipment is in first class shape, having been used only about four years, and can be delivered at once. Also a 100 K.W., 900 R.P.M. G.E. Alternator, Belted Type, 3 phase, 60 cycle, 2300 volt. Will be sold with or without the Waterwheels. Neshkoro Light & Power Co., Neshkoro, Wis.

Alternator for Sale

For Sale—One 45 K. V. A. 240 Volt, 1200 R. P. M., 3 phase, 60 cycle, revolving field Bullock alternator with sub-base main and exciter pulleys and field regulator complete. The Horning Electric & Mfg. Co., 1408 Third St., Cleveland, Ohio.

For Sale

Two 400 kilowatt, 3 phase, 60 cycle, 440 volt Westinghouse turbo-generators, 3,600 r.p.m. complete with two La Blanc motor driven condensers, also necessary panels, instruments and exciters. Forty or more motors ranging from 5 to 100 horsepower—mostly "CCL." Two 22 x 44 x 48 Cross Compound Corliss 4 valve engines, and 60 r.p.m., 150 pound pressure. Three 250 horsepower and one 300 horsepower horizontal water tube boilers, insured for 150 pound pressure and equipped for oil burning, also necessary feed pumps, gauges, valves and large piping, to headers. All the above in good operating condition and ready for immediate shipment. Box 864, Elec. World.

Plant for Sale

1—50 HP. Fairbanks, Morse gas producer.
1—43 HP. Fairbanks, Morse 2-cyl. vert. gas engine.
1—36 K.V.A. E. M. Co. 2300-volt, 60-cycle, 3-phase, rev. field alternator.
1—1½ KW. G. E. Co. exciter.
1—Two-circuit Westinghouse switchboard.
Air compressor, blower, small gasoline engine, cir. pump, air and water tanks, all piping, etc., complete plant equipment, used about two years, in excellent condition, giving splendid service, ready for immediate delivery. Windham Electric Co., Windham, Ohio.

Generator for Sale

For Sale—Westinghouse alternating current generator, 260 K.W., 2300 volts, three phase, 60 cycles, rotating field, 16 poles. Has been used three years and is in perfect condition. Municipal Electric Light Plant, Topeka, Kansas.

For Sale Cheap

Approximately 100 ornamental cast-iron boulevard type four-light lamp posts, lamps arranged three pendant and one upright. Drawings, photos and other details on application. Box 954, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

MISCELLANEOUS WANTS

Machine Shop Work

Our Jobbing Department is in a splendid position to handle light and medium weight machine shop work. New plant, modern tools, high grade mechanics and excellent shipping facilities. Prompt service, quality work guaranteed. Send samples or blue prints. The Pneumelectric Machine Co., Syracuse, N. Y.

Money Is Lost

when you do not find a right buyer for your second-hand motors or castouts due to repairs or change of voltage, etc. We would be pleased to hear from manufacturers and power plants having motors, dynamos or machinery for sale. We buy entire plants. Schwartz & Land, 91 Centre St., New York, N. Y.

Notice

On account of change in our power supply we are offering for sale our present equipment, consisting of one 160-K.W. G.E. direct connected unit and a number of motors, all in first-class condition. Detailed list and prices furnished on application. Kilby Frog & Switch Company, P. O. Box 914, Birmingham, Alabama.

Address Wanted

Mr. Louis Keim:—Please communicate at once with Mr. Chas. Steele regarding new plant to be erected. Address Box 835, Elec. World.

Manufacturing in Canada

Reciprocity is dead. If you want your full share of Canadian trade, you must establish a factory in Canada. Consult us about the best location. We can furnish up-to-date information about every commercial town in Canada, shipping facilities, power available, supply of raw material, existing industries, labor conditions, and the inducements offered to new industries. We have fully equipped factories for sale. Send full particulars of your requirements to Industrial Department, Heaton's Agency, Toronto.

Assistant in Electrical Engineering Wanted

Wanted—By an Eastern college, an assistant in electrical engineering. Laboratory and class room instruction. Only a trained, experienced man wanted, preferably one with commercial as well as teaching experience. Immediate replies desired, giving references, together with full statement of training, commercial and teaching experience. Present salary and least salary considered. Box 944, Elec. World.

Back Numbers Wanted

Back numbers of Electrical World. We will pay 20 cents each for 50 copies of Electrical World, March 5, 1904, and January 7, 1905, delivered to us in good condition. We want a few December 19, 1908; January 2, 1909; August 26, September 9, October 14, 1911; September 7, 1912. We want sets and runs of Electrical Journal, General Electric Review, Natural Electric Light Association, Electrician, Electrical Review (London), Electrical Congress (St. Louis). International Magazine Company, Elizabeth, N. J.

Light and Power Plant Wanted

Wanted—To purchase a light and power plant in town of 2500 population or larger. Robert S. Ashe, Richmond, Ind.

Controller or Starting Box Wanted

Wanted—Good second-hand controller or starting box, sufficient capacity to start 150 hp, 230 v., direct current motor slowly enough to take eight minutes to attain speed. State lowest cash price, condition, make, number of contacts or levers, type, serial number and all particulars. Cahill, 535 West 56th Street, New York.

Motor Wanted

Wanted—Will buy cheap for cash one 250 or 300-hp, 60-cycle, 440-volt, slip-ring, low-speed motor of standard make. Address, giving full details. Box 953, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

PATENTS WANTED

A company manufacturing several electrical devices is in the market for patents or designs on electrical devices which will appeal to the central station trade. Arrangements on a royalty basis or outright purchase of patent rights can be arranged. Address, giving full information, to Box 659, Elec. World.

PROPOSALS

TREASURY DEPARTMENT, OFFICE OF the Supervising Architect, Washington, D. C., June 24, 1913. Sealed proposals will be received at this office until 3 o'clock P .M. on the 28th day of July, 1913, and then opened, for a conduit and wiring system in the United States Marine Hospital, Chicago, Ill., in accordance with drawings and specification, copies of which may be had at this office or at the office of the custodian, United States Marine Hospital, Chicago, Ill., at the discretion of the Supervising Architect. O. WENDEROTH, Supervising Architect.

NOTICE OF RECEPTION OF PROPOSALS FOR THE INSTALLATIONS OF A MUNICIPAL ELECTRIC LIGHTING PLANT AND OUTSIDE DISTRIBUTION.

Binghamton, N. Y., June 25, 1913.

Notice is hereby given that sealed proposals will be received by the Board of Contract and Supply, City of Binghamton, N. Y., until Wednesday, July 16, 1913, at 4 o'clock in the afternoon, for the installation of a municipal electric lighting plant and outside distribution, in accordance with the plans and specifications now on file with the City Clerk of the City of Binghamton.

Copies of plans and specifications can be obtained from Douglas Sprague and associates, Consulting Engineers, 39-41 Cortlandt Street, New York City, or from John A. Giles, City Engineer, Binghamton, N. Y., for which a deposit of $75.00 will be required, $50.00 of which will be returned to parties bidding on such work and $25.00 to be returned to all parties not bidding, upon return of plans and specifications to the City Clerk; checks to be certified and made payable to F. M. Hopkins, City Clerk.

All proposals must be directed to Mr. F. M. Hopkins, City Clerk, Binghamton, N. Y., and must be sealed and endorsed on the outside to indicate clearly the contents, and must be delivered to the City Clerk on or before the date and time mentioned. No proposals will be received after the hour mentioned.

Proposals must be accompanied by cash, New York draft or certified check in the sum of 5 per cent of the amount of such proposal or a bid bond in the sum of twenty-five per cent of proposal, payable to F. M. Hopkins, City Clerk, and the party or parties to whom the work shall be awarded shall be required to furnish a surety company's bond (said company doing business in the State of New York) for the faithful performance of the work in the sum equal to 50 per cent of the amount of said proposal.

The Board of Contract and Supply reserves the right to reject any or all bids should it be deemed to the best interest of the city to do so.

By order of the Board of Contract and Supply.

F. M. HOPKINS,
Clerk.

POSITIONS WANTED

SOUTH AMERICA or tropics—Electrical engineer experienced in high tension power transmission producer gas engines, pumping machinery, construction work, operating, holding position as chief electrical engineer in similar work in tropics looking for wider field. Box 903, Elec. World.

ASSISTANT ENGINEER, technical man, '05, age 31, married; factory apprentice and draughtsman; sales and construction experience with medium sized power and lighting plants complete, motor applications and installations to pumps, hoists, shafting; position desired as assistant in well-organized medium sized central power plant. Investor, Box 923, Elec. World.

SALES ENGINEER wants to represent manufacturer in New York and vicinity; extensive acquaintance; wide experience. Can produce business with article or product of merit. Box 220, Elec. World.

ELECTRICAL ENGINEER and manager. A-1 man who knows the game from A to Z, in gas and electric plants open for engagement. Will guarantee to double your earnings. Box 920, Elec. World.

MANAGER of established reputation will put your plant in high class order and guarantee to double your earnings and curtail operating expenses. Box 425, Elec. World.

POWER SALES ENGINEER connected with one of the largest central station organizations in the country will act as power department for companies which have not men of sufficient experience in the commercial power field to secure permanent power consumers, and advise as to installations. Moderate payment on commission basis or stated fee. Full information on request. Member of National Electric Light Association and Commercial Section. Box 931, Elec. World.

ELECTRICAL ENGINEER, graduate 1906, draftsman, designing, constructional ability in layouts of power houses, substations, underground or overhead transmission, practical; at present with consulting engineer. Desires change. Box 952, Elec. World.

POSITION WANTED by man, 38, married, twenty years in central station work, ten years as chief engineer, four years superintendent. Desires similar position. New England preferred. Good references. Box 933, Elec. World.

SALES ENGINEER, with several years' experience wants to represent machinery or specialty manufacturer on the Pacific Coast. Know trade of entire coast including British Columbia. Best of references. Correspondence solicited. Box 928, Elec. World.

POSITION wanted, as assistant estimator and solicitor by man, 27 years of age, 10 years' practical experience in electrical contracting, technical graduate, single, can furnish bond if necessary. Ambition to work, employed now at New York. Box 927, Elec. World.

YOUNG MAN, 24, with a partly completed night course in electrical engineering desires situation where ability and energy will bring advancement. Three years' experience in underground cable and conduit work and in the signal departments of two railroads. Box 878, Elec. World.

EXPERT transmission line engineer and superintendent wants position. Box 852, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

MANAGER wants to take charge of small central station on a small salary and a percentage of increase in net earnings. Box 902, Elec. World.

ELECTRICAL ENGINEER, age 27, several years in charge of installations of light and power equipments, also central station experience, desires position with opportunities for advancement. Box 943, Elec. World.

TECHNICAL electrical graduate, 27, four years' shop testing and two years of drafting, including electrical installations and motor designing, desires position with consulting engineer or contractor. Box 876, Elec. World.

POSITIONS WANTED

SALES MANAGER having selling connections with all the electrical jobbers and contractors in New York City and vicinity, desires position as salesman or agent for a reliable manufacturer. Only established companies need reply. Box 947, Elec. World.

MECHANICAL ENGINEER having charge of several steam-electric, gas-producing central stations and heating plants wishes to make change. Employed by same company four years and knows by practical experience how to make all repairs as well as direct work. Can handle men to advantage and thoroughly understands maintenance and construction. Best reference, and strictly sober. State salary. BOX 962, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

YOUNG MAN with two years' electrical construction and operating experience and two years' technical education wants position. West or Middle West preferred. Box 960, Elec. World.

GRADUATE ELECTRICAL engineer, 31, with 8 years' experience on construction and installation of hydroelectric plants and paper mills, open for position. Box 958, Elec. World.

SUCCESSFUL mechanical and electrical engineer desires change. 10 years' broad experience in responsible positions. Personal interview solicited. Box 957, Elec. World.

ELECTRICAL SUPERINTENDENT and estimator with 12 years' experience with large and small construction altering and repair work, public and private, all systems and voltages, with some trade following in New York. Thoroughly competent to estimate, supervise and handle a responsible position. Box 965, Elec. World.

TECHNICAL GRADUATE, 29, married, 7 years' business experience, advertising, catalog work, buying, correspondence, office systems, etc.; best references; wants position with contractor or manufacturer. Box 963, Elec. World, 1570 Old Colony Bldg., Chicago, Ill.

TECHNICAL graduate in electrical and mechanical engineering, with 4 years' experience in a telephone plant, both inside and out, desires position. Can handle men and get results. Eastern location preferred. Box 961, Elec. World.

MOTOR SERVICE engineer will consider change. Capable executive for new business department. Graduate B.S. with wide experience in sales and technical lines. Want responsible position. Box 951, Elec. World.

ENGINEER, machinist, electrician, 38, New York license. Thorough mechanic, eighteen years' experience alternating and direct current apparatus. Jos. H. Nowark, 409 East 69th St., N. Y City.

TECHNICAL MAN, one year practical experience, wishes position where he can get further practical experience, motor work preferred. Box 949, Elec. World.

TECHNICAL graduate in electrical engineering with 3 years' shop testing and 1 year power house design seeks position as instructor. Box 910, Elec. World.

New Business Manager

qualified for both operating and new business work, wants position beginning July 15th, in gas, electric or combined company ANYWHERE. Ten years' technical and commercial experience. Salary secondary, opportunity for securing an interest in company is afforded. Speaks English and German. Box 939, Electrical World, 1570 Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

DRAFTSMAN WANTED with experience in the design of electrical apparatus. In answering state age, education, experience, salary expected, and time you can begin work. Address Chief Draftsman, Wagner Electric Mfg. Co., St. Louis, Mo.

Two (2) foremen electricians wanted, familiar with motors, generators and lighting installations, capable of following construction work and handling men efficiently. Information as to experience, personality and salary required must accompany application. Box 922, Elec. World.

A CAPABLE CABLE SPLICER wanted on 6600 and 220-volt work. Permanent position under good conditions for proper party. Must be of good habits and with either technical training or practical experience. Box 919, Elec. World.

REPAIR MAN for car barn wanted; one who can rewind armatures, repair controllers, and do general maintenance work on equipments. Salary, $75 per month. Position permanent for right man. Only men with experience who can furnish good references need apply. Box 940, Elec. World.

METER TESTER and repairman experienced on Sangamo and General Electric D. C. meters wanted; also competent instrument repairmen for switchboard work. Address Laboratory, Duquesne Light Company, 5918 Broad Street, Pittsburgh, Pa.

ASSISTANT BUSINESS MANAGER WANTED by the largest technical magazine publishing house in the South. Must be well educated, about 25 years old, able to show a clean record, of robust health, acquainted with the advertising and publishing business, able to handle correspondence and experienced in the dictation of letters. Atlanta is the South's most progressive and prosperous city. Salary to start, $25 per week, with every opportunity for advancement for the man with ability and inclination to make a record for himself. Address Cotton Publishing Co., Atlanta, Ga.

Salesman Wanted

Experienced in illuminating engineering. Give experience, salary and full details. P. O. Box 1573, Milwaukee, Wis.

Salesman Wanted

WANTED—Good, live, experienced salesman for switchboard and panelboard business. None but good, live men and those who can positively make good need apply. Box 942, Elec. World.

EDUCATIONAL

METERMEN WANTED to enroll for complete practical course on "Electrical Measuring Instruments and Meters." Endorsed by leading electrical men. Write for booklet, "Instruments and Meters," giving full information. Fort Wayne Correspondence School, No. 913 Shoaff Bldg., Fort Wayne, Ind.

RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y.—Courses in Civil, Mechanical and Electrical Engineering and General Science, leading to the degree of Civil Engineer (C.E.), Mechanical Engineer (M. E.), Electrical Engineer (E.E.), and Bachelor of Science (B.S.). Special courses in Engineering and Science. Splendidly equipped new Engineering laboratories. Send for catalogue to the Registrar.

BLISS ELECTRICAL SCHOOL, Washington, D. C.—Condensed course in electrical engineering complete in one year. Thorough—practical—scientific. Theoretical and applied electricity, mathematics, mechanical drawing and necessary engineering training. No superficial or non-essential studies. Actual construction, installation and testing. For young men of energy and character; 21st year opens Sept. 24. Write for catalogue. Address 25 Takoma Ave.

ROSE POLYTECHNIC INSTITUTE, Terre Haute, Indiana.—A college of engineering; courses in mechanical, electrical, civil and chemical engineering and architecture. Extensive shops, well-equipped laboratories in all departments, expenses low; 30th year. For catalogue containing full information and professional register of alumni, address C. L. Mees, President.

NEW LIST PRICES

on

Laco Quality

Wire Drawn Tungsten Lamps

Effective July 1st, 1913

Write for Complete List and Discounts

LACO-PHILIPS COMPANY

131 Hudson Street
New York City

27 Common Street
Montreal, Canada

READY-REFERENCE INDEX

to products manufactured by advertisers in this issue of Electrical World

Nearly 300 different products are here listed.

The Alphabetical Index (see fourth page following) gives the page number of each advertisement.

As far as possible advertisements are so arranged that those relating to the same kind of goods or apparatus will be found together.

This ready-reference index is up to date, changes being made each week.

If you don't find listed in these pages any electrical product of which you desire the name of the maker, write or wire Electrical World, and we will promptly furnish the information.

Air Compressors
Allis-Chalmers Mfg. Co.
Murray Iron Works.
Platt Iron Works.

Aluminum.
Aluminum Co. of America.

Ammeters, Voltmeters.
(See Instruments, Electrical.)

Anchors, Guy.
Barnes & Kobert Mfg. Co.
Matthews & Bro., W. N.
Universal Cable Grip Co.

Annunciators.
Ostrander & Co., W. R.
Western Electric Co.

Asbestos, Wood.
Johns-Manville Co., H. W.

Automobiles, Elec.
(See also Vehicles, Elec.)
General Motors Truck Co.

Ball Bearings.
Hess-Bright Mfg. Co.
Norma Co. of America.

Batteries, Dry Cell.
Manhattan Elec'l Supply Co.
National Carbon Co.
Nungesser Carbon & Btty. Co.

Batteries, Storage.
Edison Storage Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.
U. S. Light & Heating Co.
Willard Storage Battery Co.

Battery Connections.
Fahnestock Electric Co.

Bells.
Manhattan Elec'l Supply Co.
Ostrander & Co., W. R.
Western Electric Co.

Belting.
Chicago Rawhide Co.

Binding Posts.
Fahnestock Electric Co.

Boilers.
Babcock & Wilcox Co.
Murray Iron Works.

Bolts, Expansion.
Hubbard & Co.

Bond Testers.
Machado & Roller.

Books, Technical.
International Textbook Co.
McGraw-Hill Book Co.

Boosters.
C & C Electric Mfg. Co.
Crocker-Wheeler Co.
Ridgway Dynamo & Eng. Co.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

Boxes, Fire Alarm.
Siemens Companies.

Boxes, Fuse.
Matthews & Bro., W. N.

Boxes, Junction and Outlet.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Johns-Manville Co., H. W.
Sprague Electric Works.

Boxes, Meter & Service.
Johns-Manville Co., H. W.

Brackets and Pins, Metal.
Hubbard & Co.

Bridges.
American Bridge Co.

Brushes, Dynamo.
Corliss Carbon Co.
Jeandron, W. J.
Le Valley Vitae Carbon B. Co.
Morgan Crucible Co., Ltd.
National Carbon Co.
Speer Carbon Co.

Bushings.
Condit Electrical Mfg. Co.

Cables, Electric.
Siemens Companies.

Cable End Bells.
Electrical Engrs' Equip. Co.

Cable Grips.
Universal Cable Grip Co.

Cable Joints.
Fahnestock Electric Co.

Cable Junction Boxes.
G & W Electric Specialty Co.

Cable Racks.
Cope, T. J.

Cable Rollers.
Matthews & Bro., W. N.

Cable Splicing Joints.
Matthews & Bro., W. N.

Cabling Machinery.
American Ins. Mach'y Co.
New England Butt Co.

Car Heaters, Electric.
Simplex Electric Heating Co

Car Lighting.
U. S. Light & Heating Co.

Carbons.
Hirschberg Co., H. M.
Koerting & Mathiesen Co.
National Carbon Co.
Reisinger, Hugo.

Castings.
Pittsburgh Valve, F. & C. Co.
Triumph Electric Co.

Chains, Driving.
Morse Chain Co.

Chandeliers.
Beardslee Chandelier Mfg. Co.
Benjamin Elec. Mfg. Co.
Goodwin & Kintz.
Johns-Manville Co., H. W.

Circuit Breakers.
Bowie Switch Co.
Condit Electrical Mfg. Co.
Cutter Co.
General Electric Co.
Machado & Roller.
Roller-Smith Co.
Sundh Electric Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Clamps, Ground Connection.
Belden Mfg. Co.

Clamps, Guy.
Barnes & Kobert Mfg. Co.
Matthews & Bro., W. N.
Universal Cable Grip Co.

Cleats.
American Vul. Fibre Co.
Blake Signal & Mfg. Co.
Colonial Sign & Ins. Co.
Imperial Porcelain Co.
Pass & Seymour, Inc.
Sears, Henry D.

Climbers.
Cincinnati Tool Co.
Klein & Sons, Mathias.

Clips, Cable.
Matthews & Bro., W. N.

Clusters.
Benjamin Electric Mfg. Co.
Hubbell, Inc., Harvey.

Coils, Armature Field.
D & W Fuse Co.
Independent Lamp & Wire Co.

Coils, Choke.
Railway & Industrial Eng. Co.

Coils, Induction.
Ostrander & Co., W. R.
Splitdorf Elec'l Co.
Western Elec. Co.

Coils, Spark.
Western Elec. Co.

Commutator Truers.
Bryant-Berry Steam Tur. Co.
Jordan Bros.

Compounds, Boiler.
Dearborn Chemical Co.

Compounds, Commutator.
McLellan Co., K.

Condensers.
Allis-Chalmers Mfg. Co.
Deane Steam Pump Co.
Platt Iron Works.
Westinghouse Machine Co.
Wheeler Mfg. Co., C. H.

Conduit Bends.
Fibre Conduit Co.

Conduit Fittings.
Central Electric Co.
Sprague Electric Works.

Conduit Rods.
Cope, T. J.

Conduits, Interior.
American Conduit Mfg. Co.
Central Elec. Co.
Sprague Electric Works.
Tubular Woven Fabric Co.

Conduits, Underground.
American Conduit Co.
American Vit. Conduit Co.
Fibre Conduit Co.
Gest, G. M.
Michigan Pipe Co.
National Conduit & Cable Co.

Conduit Wiring Machines.
Pneumatic Cond. Threader Co.

Controllers.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Monitor Controller Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Westinghouse Elec. & Mfg. Co.

Conveying Machinery.
(Coal, Ashes, Etc.)
Green Engineering Co.
Morse Chain Co.
Northern Engineering Works.

Cooling Towers.
Wheeler Mfg. Co., C. H.

Cord Adjusters.
American Vul. Fibre Co.

Cord, Arc Lamp.
Samson Cordage Works.

Cord, Flexible.
American Electrical Works
Belden Mfg. Co.

Cord, Trolley.
Samson Cordage Works.

Couplings.
Smith-Serrell Co., Inc.

Couplings, Flexible.
Bruce-Macbeth Engine Co.

Crane Motors.
Crocker-Wheeler Co.
Sprague Electric Works.
Triumph Electric Co.
Westinghouse Elec. & Mfg. Co.

Cranes, Traveling.
Northern Engineering Works.
Maris Bros.

Cross-Arms.
Central Elec. Co.
Western Electric Co.

Cutouts.
D & W Fuse Co.
G & W Electric Specialty Co.
Sears, Henry D.

Cutouts (Automatic).
Thompson Elec. Co.

Dies.
Col's Die, Tool & Machine Co

Drills.
Cincinnati Tool Co.

Drills, Brick.
Hubbard & Co.

Drills, Electric.
Siemens Companies.

Drills, Portable.
Stow Mfg. Co.

Dynamos and Motors.
Allis-Chalmers Mfg. Co.
Burke Electric Co.
C & C Electric Mfg. Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
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Gregory Electric Co.
Kimble Electric Co.
Lincoln Electric Co.
Reliance Elec. & Eng'g Co.
Richmond Elec. Co.
Ridgway Dynamo & Eng. Co.
Robbins & Myers Co.
Roth Bros. & Co.
Siemens Companies.
Sprague Electric Works.
Stow Mfg. Co.
Triumph Electric Co.
Wagner Electric Co.
Westinghouse Elec. & Mfg. Co.

Electromagnets
Cutler-Hammer Mfg. Co.
Elec. Controller & Mfg. Co.
Sundh Electric Co.

Engineers, Consulting.
(See Directory of Engineers.)

Engineers, Contracting.
(See Directory of Engineers.)

Engines, Gas and Gasoline.
Allis-Chalmers Mfg. Co.
Bruce-Macbeth Engine Co.
Carlisle & Finch Co.
Otto Gas Engine Works.
Westinghouse Machine Co.

Engines, Oil.
Covington Machine Co.
Remington Oil Engine Co.

Engines, Steam.
Allis-Chalmers Mfg. Co.
Ball Engine Co.
McIntosh & Seymour Co.
Murray Iron Works.
Ridgway Dynamo & Eng. Co
Westinghouse Machine Co.

Experimental Apparatus.
Biddle, James G.
Esterline Co.
Machado & Roller.
Union Electric Co.

Fan Motors.
Century Electric Co.
Colonial Fan & Motor Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
General Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Union Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

Fans (Exhaust and Ventilating).
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
Kimble Electric Co.
Sprague Electric Works.
Westinghouse Elec. & Mfg. Co.

Fibre (See Insulating Material).

Fibre Tubing.
American Vul. Fibre Co.
Continental Fibre Co.
Fibre Conduit Co.

READY-REFERENCE INDEX

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Massachusetts Chemical Co.

Financial.
Coal & Iron National Bank.
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NOTICE TO ADVERTISERS:

Printing begins on Monday of each week.

Changes of copy received up to 10 A. M. Monday will appear in the issue of that week, but no proofs can be submitted before publication.

New Advertisements (not changes of copy) received up to Wednesday noon can appear in the issue of that week, but no proofs can be shown.

If proofs before printing are required changes of copy and copy for new advertisements must be in our hands ten days in advance of the date of publication.

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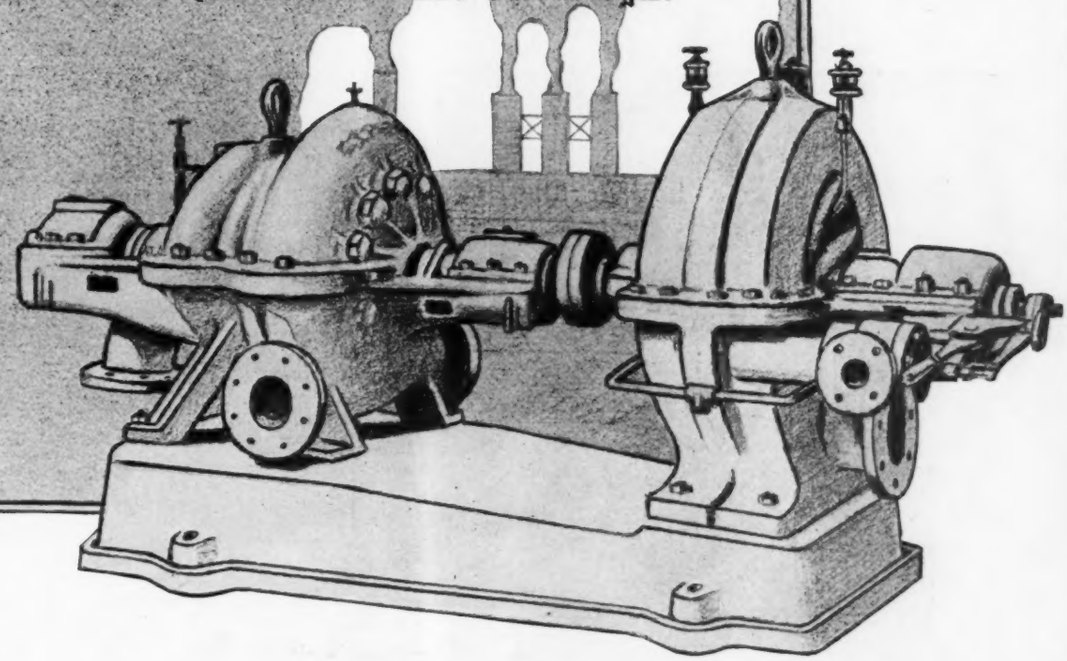

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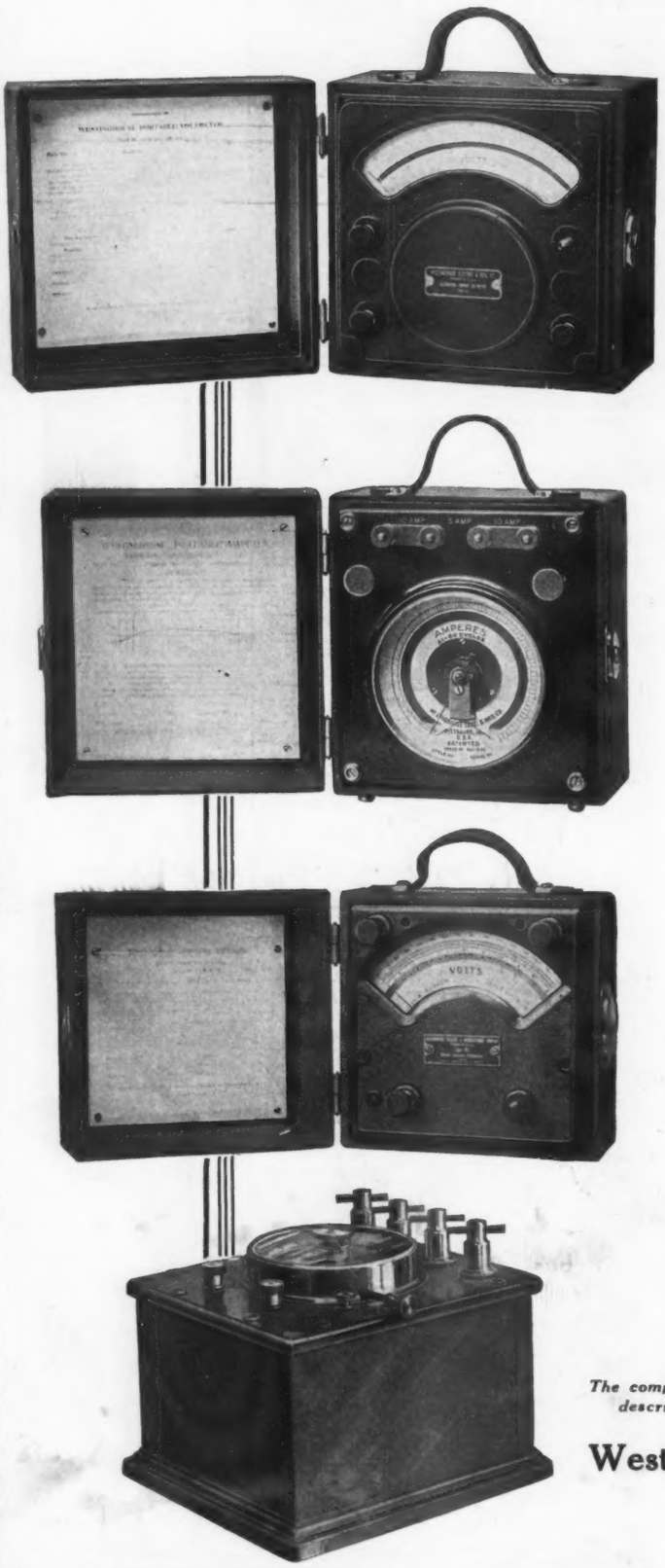

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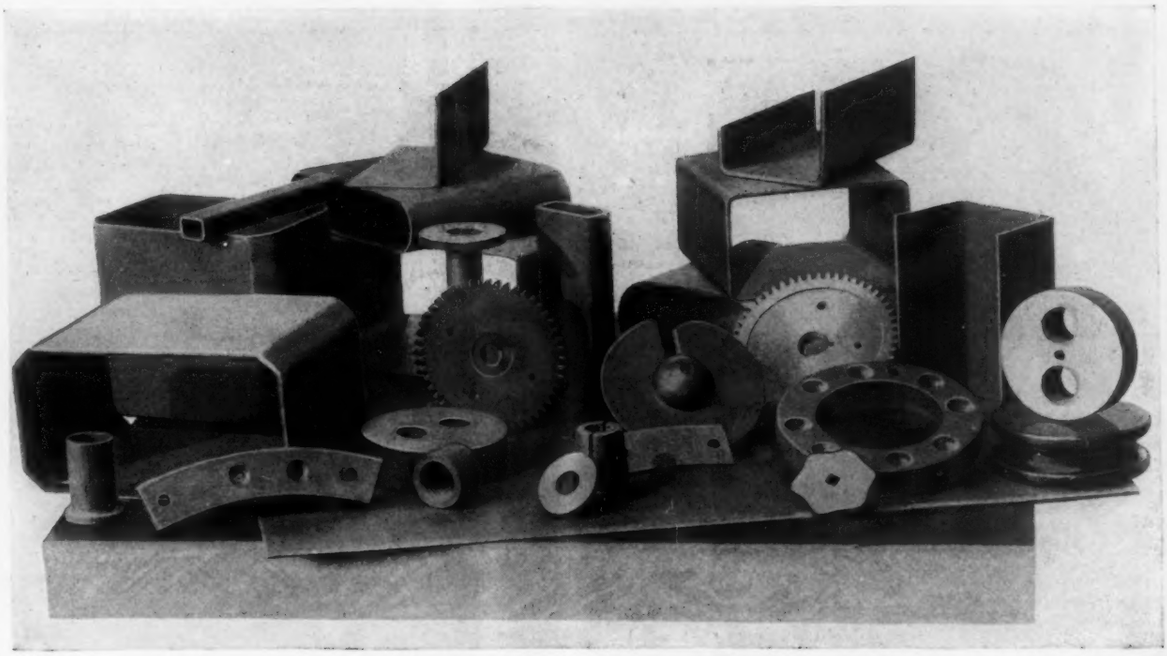

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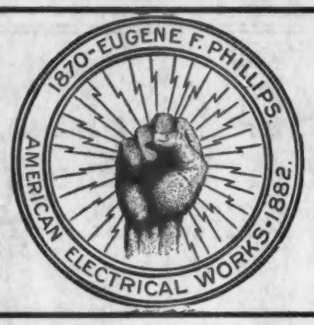

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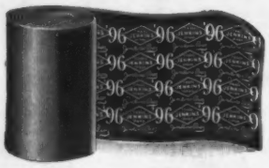

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